NBS SPECIAL PUBLICATION 395

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

Simulation and Gaming

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards[1] was established by an act of Congress March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau consists of the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Institute for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of a Center for Radiation Research, an Office of Measurement Services and the following divisions:

Applied Mathematics — Electricity — Mechanics — Heat — Optical Physics — Nuclear Sciences[2] — Applied Radiation[2] — Quantum Electronics[3] — Electromagnetics[3] — Time and Frequency[3] — Laboratory Astrophysics[3] — Cryogenics[3].

THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement, standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; provides advisory and research services to other Government agencies; and develops, produces, and distributes standard reference materials. The Institute consists of the Office of Standard Reference Materials and the following divisions:

Analytical Chemistry — Polymers — Metallurgy — Inorganic Materials — Reactor Radiation — Physical Chemistry.

THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations leading to the development of technological standards (including mandatory safety standards), codes and methods of test; and provides technical advice and services to Government agencies upon request. The Institute consists of a Center for Building Technology and the following divisions and offices:

Engineering and Product Standards — Weights and Measures — Invention and Innovation — Product Evaluation Technology — Electronic Technology — Technical Analysis — Measurement Engineering — Structures, Materials, and Life Safety[4] — Building Environment[4] — Technical Evaluation and Application[4] — Fire Technology.

THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides technical services designed to aid Government agencies in improving cost effectiveness in the conduct of their programs through the selection, acquisition, and effective utilization of automatic data processing equipment; and serves as the principal focus within the executive branch for the development of Federal standards for automatic data processing equipment, techniques, and computer languages. The Institute consists of the following divisions:

Computer Services — Systems and Software — Computer Systems Engineering — Information Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System; provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

Office of Standard Reference Data — Office of Information Activities — Office of Technical Publications — Library — Office of International Relations.

---

[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Part of the Center for Radiation Research.
[3] Located at Boulder, Colorado 80302.
[4] Part of the Center for Building Technology.

Simulation and Gaming

Proceedings of the 12th Annual Symposium
National Gaming Council
and the
4th Annual Conference
International Simulation and Gaming Association

Held at the National Bureau of Standards,
Gaithersburg, Md., September 17-19, 1973

Edited by

John E. Moriarty

Technical Analysis Division
U.S. National Bureau of Standards
Washington, D.C. 20234

Sponsored by the
National Bureau of Standards
In Cooperation With
The United States Environmental Protection Agency
Washington, D.C. 20460
and
Rutgers University,
New Brunswick, N.J. 08903

t. Special publication no. 395

U.S. DEPARTMENT OF COMMERCE, Frederick B. Dent, *Secretary*
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, *Director*

Issued June 1974

Library of Congress Cataloging in Publication Data

National Gaming Council.
Simulation and gaming.

(National Bureau of Standards Special Publication 395)
"Sponsored by the National Bureau of Standards in cooperation with the United States Environmental Protection Agency ... and Rutgers University."

Supt. of Docs. No. C13.10:395.
1. Game theory—Congresses. 2. Simulation methods—Congresses. I. Moriarty, John E., ed. II. International Simulation and Gaming Association. III. United States. National Bureau of Standards. IV. United States. Environmental Protection Agency. V. Rutgers University, New Brunswick, N.J. VI. Title. VII. Series: United States. National Bureau of Standards. Special Publication 395.

QC100.U57 No. 395 [QA269] 389'.08s [519.3] 74-7048

National Bureau of Standards Special Publication 395

Nat. Bur. Stand. (U.S.), Spec. Publ. 395, **458** pages (June 1974)

CODEN: XNBSAV

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON: 1974

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
(Order by SD Catalog No. C13.10:395). Price $4.25
Stock Number 0303-01300

TABLE OF CONTENTS

ABSTRACT

This volume contains the Facilitator's Statements and Formal Papers presented at a Conference on Simulation and Gaming sponsored by the Technical Analysis Division of the National Bureau of Standards in cooperation with the United States Environmental Protection Agency and Rutgers University and held from September 17 to 19, 1973.

There are five Facilitator Statements and eleven formal papers on the theory and evaluation of Simulation Gaming, ten Facilitator Statements and twelve formal papers on Gaming Applications, along with Task Group Summaries and Game Demonstration Descriptions.

The formal papers and Facilitator Statements are presented by both United States and foreign authors and represent a significant treatise on the world-wide "state of the art" in Simulation and Gaming.

Key Words: Cognitive Retention; Computer; Decision-making; Education; Elementary-secondary education; Gaming; Health; Instructional; Learning systems; Management; Medicine; Model; Public policy; Recognition behavior; Regional; Research applications; Sex; Simulation; Social simulation; Teacher-training; Urban; Validation; Welfare

FORWARD

These proceedings are the results of a conference held on September 17-19, 1973 at the National Bureau of Standards. The conference was a working conference in which members of the National Gaming Council and the International Simulation and Gaming Association share their ideas between the participants and other interested parties.

The conference stressed the theory, design, and applications of simulation and game design along with live demonstrations of computerized games. The contributions to these proceedings are many and varied. Each major section contains both formal papers and transcripts of the various panel meetings and working sections.

The editor wishes to acknowledge the cooperation of the staff of the United States Environmental Protection Agency and the staff of the Sociology Department, Douglass College, Rutgers University. Special thanks for the tireless effort by the Program Chairman, Dr. Cathy Greenblat and Co-chairman for Proceedings and Arrangements, Dr. Peter House. Finally, the Conference Coordinators, Mr. Albert Pines, Mr. Martin Brossman, of the Environmental Studies Division, Washington Environmental Research Center, and Miss Carol Naas, Mrs. Diane Beall, and Mrs. Mary Abbott of the NBS staff deserve the thanks of all concerned for their cooperation and dedication.

John E. Moriarty
Technical Analysis Division
National Bureau of Standards
January 16, 1974

WELCOMING ADDRESS TO THE NATIONAL GAMING COUNCIL AND THE INTERNATIONAL SIMULATION AND GAMING ASSOCIATION -- September 17, 1973

By Ernest Ambler, Deputy Director, National Bureau of Standards

I am pleased to welcome you on behalf of Richard Roberts, the Bureau's Director, and all the staff of the National Bureau of Standards. It is a pleasure to host the first Joint Conference of the National Gaming Council and the International Gaming and Simulation Association. I would like to extend a special welcome to those visitors who come from overseas and to those of you who are here at the Bureau of Standards for the first time.

As many of you know, the Bureau of Standards is one of the largest and most technologically diversified laboratories of the government. It was founded in 1901, when uniformity of measurements was a very acute problem in this country. In Brooklyn there were no less than four measures for the foot, while people were selling commodities with the slogan: "Buy from us; our pound is bigger than our competitor's." At the same time industrial developments were reaching the point where accurate measurements and reliable data were sorely needed. The Bureau's charter was designed to attack these problems. The charter was very broadly written, has served us well and has needed very little amendment through the years. Among the many things that we are enjoined to do is to support other government agencies, particularly in the application of science and technology for the public's benefit.

Today, the Bureau, with some modifications, provides the same basis of measurement that it has since its inception in 1901. For example, we deal with the technical basis, both nationally and internationally, for measurement systems; we provide scientific and technological services to government and industry; we attempt to provide a technical basis for equity in trade; and we provide technical services to promote public safety.

There is a definite connection between the past and present contributions of the Bureau of Standards and your special interests here at this Conference. As early as 1954 we were engaged in the development and implementation of simulation models. These initial efforts were largely in support of Defense programs, and some of you might recall that the earliest computer war games were run on the Bureau-of-Standards-built SEAC computer. A portion of the work was concerned with the simulation and replication of experiments in the basic sciences and engineering. These and other developmental activities pointed to the requirement for mathematical algorithms, statistical tools, numerical analysis techniques, distribution tables, and random number generators. NBS has made many contributions in these areas.

Moving to the 60's the direction of the work and that of the simulation community in general expanded to the civil sector. Here at the Bureau large network analysis problems were undertaken and simulation techniques for resource allocations were developed and tested. Concurrently our competence and capabilities in the areas of computer science and operations research were expanded to meet these and other challenges. In the 70's we are now faced with supporting a host of new society-related programs such as fire, housing, law enforcement, and so on. Mathematical modeling and simulation are important tools in helping attack these problems For example, our charter to reduce the hazards of fire-related injury, death, and property loss requires that we investigate, through mathematical modeling, the physical phenomena of fire growth and spread. We also seek solutions to operational problems in fire protection such as the most appropriate locations for fire stations. Our programs in criminal justice and consumer product safety have clearly demonstrated the utility of the simulation approach in concert with engineering oriented developmental activities.

My remarks are intended to illustrate that a broad range of technical programs at the Bureau are modified and developed to suit the times. Many of these show a strong and continuing commitment in gaming and simulation, where competence has been developed and challenging problems have been identified. However, in order to benefit from what has been done, the exchange of ideas, information, and techniques must occur and for this reason this joint meeting on the grounds of the Bureau of Standards is most appropriate. This Conference represents a kaleidoscope of interests in the theory, design and application of modeling games and we feel there is much to be gained from the exchange of ideas and information that will occur over the next few days. We are very pleased that you are here, that you selected NBS as the site for your conference, and we wish all the participants an interesting and valuable conference.

INTRODUCTION: THE STRUCTURE AND PROCESS OF THE 1973 JOINT MEETINGS OF THE NATIONAL GAMING COUNCIL AND THE INTERNATIONAL SIMULATION AND GAMING ASSOCIATION

Cathy S. Greenblat
Department of Sociology
Douglass College, Rutgers University
New Brunswick, New Jersey 08903

Program Chairman, 1973 Joint Meetings: NGC-ISAGA

The structure and mode of operation of this year's meeting grew out of the conviction that the most important aspect of many professional meetings is the opportunity they provide for people with similar interests and problems to meet with one another. Hence the meetings were designed to create a WORKING conference--one in which we could maximize the sharing of ideas between participants. "Formal papers" were deliberately kept to a minimum, being offered as springboards to further discussion rather than as terminal presentations. Each presenter was asked to serve as a "facilitator" in a small group discussion following his or her presentation. At this time questions and challenges could be explored and amplification of ideas presented in the paper could take place. Other knowledgeable persons were identified in advance to also serve as "facilitators" in these sessions.

The initial formulation of possible topics for papers and/or discussion groups was as thorough as could be developed. The major themes around which we wished the conference to be organized--theory, evaluation, design, applications, and resources-- were made the center sectors in a wheel which attempted to delineate the relevant aspects of gaming in 1973. Fanning out from these major sectors were subdivisions with increasing detail as one moved from the center of the circle.

This conceptual wheel, modelled from those being developed by Richard Duke, was made the major element of the preliminary announcement of the meetings and the call for papers. Recipients were informed that the wheel provided a graphic overview of the possible range and scope of topics for the conference, and that particular aspects would be selected in accordance with the interests and expertise of the participants. They were then invited to help shape the program by informing me of their interests and intended contributions.

A number of people responded to this invitation, suggesting at times what they hoped to do and at other times what they hoped others would present! These responses led to the formulation of the final program. Those topics of "across-the-board" interest were made the subjects of general symposia. One was offered each day with no conflicting offerings. Three major Task Groups were set up by combining Theory-Evaluation and by dealing with Resources through one of the symposia, a display table, and a series of gaming-simulation demonstrations on both Monday and Tuesday evenings.

The final program then evolved as follows:

GENERAL SYMPOSIA

1. INTERNATIONAL DEVELOPMENTS IN GAMING SIMULATION

   Synopses of the state-of-the-art and of new developments in gaming in several countries.

   Robert H.R. Armstrong, England;
   Hank Becker, Netherlands;
   Margrit Kennedy, Germany;
   Allan Feldt, United States.

2. TOWARD A THEORY OF GAMING

   A thematic introduction to the conference and to the task groups.

   Richard D. Duke, University of Michigan.

3. PRESENT AND FUTURE RESOURCES IN GAMING-SIMULATION

   A pragmatic session led by representatives of major outlets of information and games.

   Don Coombs, Simulation/Gaming/News;
   Gail Fennessey, Academic Games Associates, and Simulation and Games: An International Journal;
   Clark Rogers, Document Retrieval Service, University of Pittsburgh;
   Irv Naiburg, Appleton Century Crofts.

4. DEVELOPMENTS AND PROSPECTS IN THEORY-EVALUATION, DESIGN, AND APPLICATIONS

   Summaries of the work of the three task groups.

TASK GROUPS

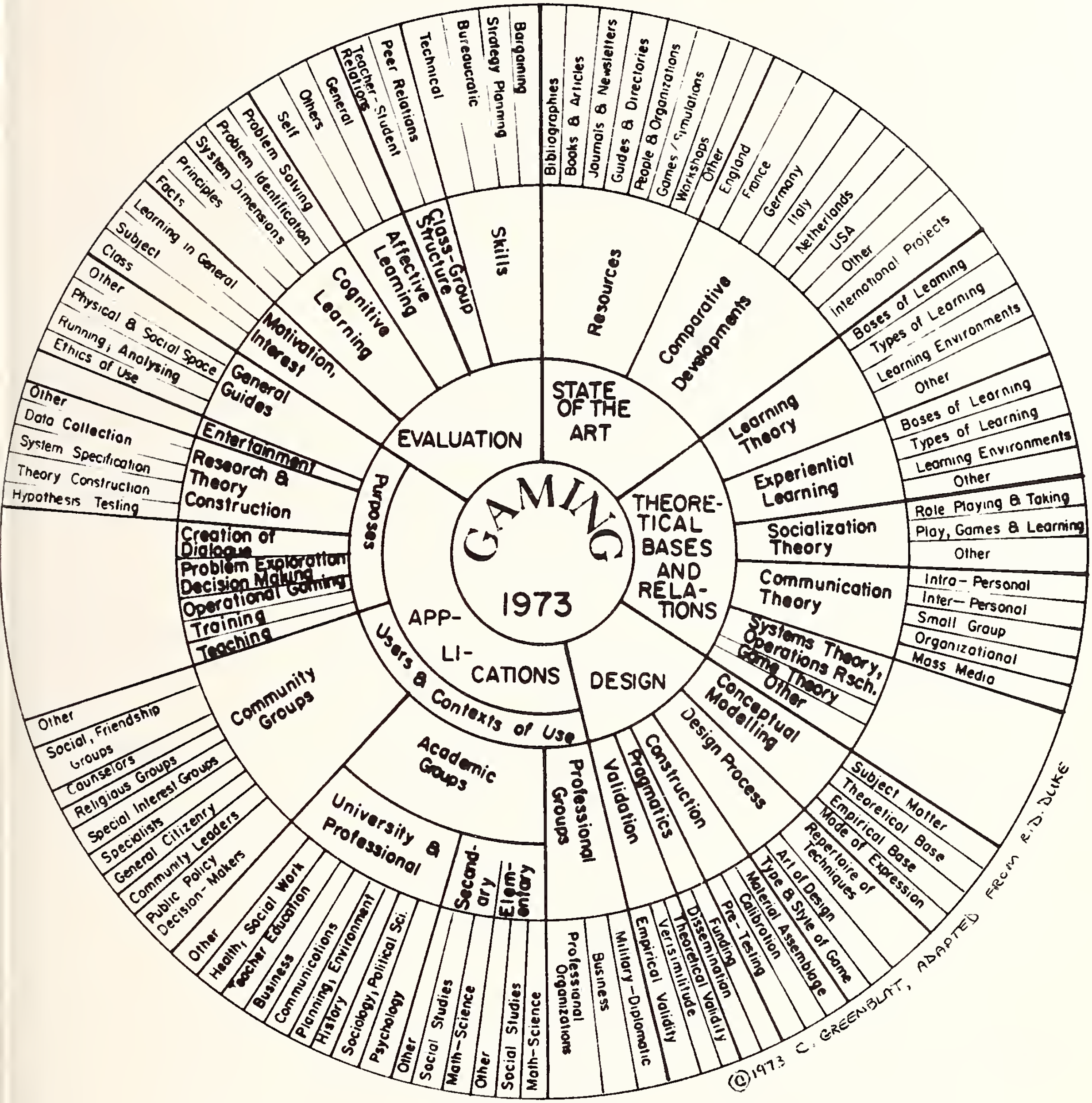
THEORY-EVALUATION: This task group explored the related elements of the theoretical bases and relationships of gaming (e.g. learning theory, communications theory, socialization theory, systems theory, operations research, etc.) and evaluation of the outcomes of gaming activities.

DESIGN: This task group addressed itself to a number of dimensions of the modelling-design-construction process.

APPLICATIONS: This task group addressed itself to questions of the extent and manner in which gaming-simulations are being utilized in a variety of contexts. The three major arenas of application which formed the basic sub-groupings were: (1) teaching and training; (2) community and public policy applications; and (3) research. The first was further sub-divided by interest area.

A full listing of the activities within the sub-groups follows:

N. G.C. - I.S.A.G.A.


GAMING
1973
STATE OF THE ART
EVALUATION
THEORETICAL BASES AND RELATIONS
DESIGN
APPLICATIONS
Resources
Comparative Developments
Skills
Class-Group Structure
Affective Learning
Cognitive Learning
Motivation, Interest
General Guides
Entertainment
Research & Theory Construction
Purposes
Creation of Dialogue
Problem Exploration
Decision Making
Operational Gaming
Training
Teaching
Users & Contexts of Use
Community Groups
Academic Groups
University & Professional
Secondary
Elementary
Professional Groups
Validation
Pragmatics
Construction
Design Process
Conceptual Modelling
Learning Theory
Experiential Learning
Socialization Theory
Communication Theory
Systems Theory, Operations Rsch., Game Theory
Other
Bibliographies
Books & Articles
Journals & Newsletters
Guides & Directories
People & Organizations
Games / Simulations
Workshops
Other
England
France
Germany
Italy
Netherlands
USA
Other
International Projects
Bases of Learning
Types of Learning
Learning Environments
Other
Bases of Learning
Types of Learning
Learning Environments
Other
Role Playing & Taking
Play, Games & Learning
Other
Intra- Personal
Inter- Personal
Small Group
Organizational
Mass Media
Subject Matter
Theoretical Base
Empirical Base
Mode of Expression
Repertoire of Techniques
Art of Design
Type & Style of Game
Material Assemblage
Calibration
Pre-Testing
Funding
Dissemination
Theoretical Validity
Verisimilitude
Empirical Validity
Military-Diplomatic
Business
Professional Organizations
Math-Science
Social Studies
Other
Math-Science
Social Studies
Other
Psychology
Sociology, Political Sci.
History
Planning, Environment
Communications
Business
Teacher Education
Health, Social Work
Other
Public Policy Decision-Makers
Community Leaders
General Citizenry
Specialists
Special Interest Groups
Religious Groups
Counselors
Social, Friendship Groups
Other
Hypothesis Testing
Theory Construction
System Specification
Data Collection
Other
Ethics of Use
Running, Analysing
Physical & Social Space
Other
Class
Subject
Learning in General
Facts
Principles
System Dimensions
Problem Identification
Problem Solving
Self
Others
General
Teacher-Student Relations
Peer Relations
Technical
Bureaucratic
Strategy Planning
Bargaining
©1973 C. GREENBLAT, ADAPTED FROM R.D. DUKE

THEORY-EVALUATION TASK GROUP

PANELS:

1. THE WHAT AND WHY OF GAMING
   Ron Stadsklev, Institute of Higher Education Research and Services, Alabama
   Layman Allen, University of Michigan
   Gerry Gutenschwager, Washington University, St. Louis

2. GENERAL PROBLEMS IN EVALUATION OF GAMING-SIMULATION
   Dan Klassen, State University of New York, Stony Brook;
   Norman Hummon, University of Pittsburgh;

3. NEW FINDINGS FROM EVALUATIVE STUDIES
   Layman Allen, University of Michigan;
   Steve Kidder, Abt Associates;
   Frank Diulus, University of Pittsburgh;
   Patricia Martin (and Marie Osmand), Florida State University;*
   Richard Schusler, University of Kansas;
   Melvyn Semmel and Sivasailam Thiagarjan, Indiana University;
   Charles Postma, Ashland College and Jay Thompson, Ball State University;
   William Stembler, Silver Springs;
   Steven Woolard, Florida State University.

SUB-GROUP MEETINGS AND FACILITATORS:

1. THEORY
   Facilitators: members of panel 1 above.

2. EVALUATION
   Facilitators: members of panels 2 and 3 above.

DESIGN TASK GROUP

PANELS:

1. MODELS OF THE GAMING-SIMULATION DESIGN PROCESS
   Charles Adair, Florida State University;
   Erwin Rausch, Didactic Systems, Inc.

2. CONCEPTUAL MODELLING AND VALIDATION OF MODELS
   Hank Becker, Sociologisch Instituut dan de Rijkuniversitat, Utrecht, Netherlands;
   Peter House, Environmental Protection Agency;
   Jerry Debenham, University of Utah;
   Klaus Dette, University of Manchester Institute of Science and Technology, England;

SUB-GROUP MEETINGS AND FACILITATORS:

1. GENERAL DIMENSIONS OF DESIGN
   - Charles Adair, Florida State University;
   - Erwin Rausch, Didactic Systems, Incorporated.

2. DEVELOPING COMPUTER-BASED SIMULATIONS
   - Marshall Whithed, Temple University;
   - Roy Miller, Environmental Simulation Laboratory, University of Michigan;
   - Phil Patterson, Environmental Protection Agency.

3. UNSTRUCTURED AND GAME-GENERATING GAMES
   - Fred Goodman, University of Michigan;
   - Klaus Dette, University of Manchester Institute of Science and Technology;

4. DESIGNING INTERACTIVE SOCIAL SIMULATIONS
   - Armand Lauffer, University of Michigan;
   - Georgeann Wilcoxon, Presbyterian Board of Christian Education.

5. FUTURES MODELLING
   - Jerry Debenham, University of Utah;
   - Dennis Little, Long Range Planning Dept., Social Security Administration

6. STUDENT-DESIGNED GAMES
   - John Hershey, University City Science Center;
   - Harriet Tamminga, University of Denver

7. FRAME GAMES: DESIGN AND REDESIGN
   - Robert H.R. Armstrong (and Margaret Hobson), Institute of Local Government, University of Birmingham, England;*
   - Fred Goodman, University of Michigan;
   - Gini Buus, Lutheran Campus Ministry;
   - Earl Mulley, Center for Simulation Studies;
   - Richard D. Duke, University of Michigan and Cathy S. Greenblat, Rutgers University.

APPLICATIONS TASK GROUP

PANELS:

1. ISSUES IN GAME USE: WHAT VALUES ARE CONVEYED BY GAME DESIGNERS AND USERS?
   - Nancy Glandon, University of Redlands;
   - Stuart Cipinko, University of Redlands;
   - George McFarland, Simulation Sharing Service.

2. USES OF GAMING-SIMULATION FOR RESEARCH
Richard Dukes, University of Colorado;
Robert Sarly, Central Polytechnic of London;
Gail Fennessey, Academic Games Associates;
Conrad Weiler, Temple University.

3. PUBLIC POLICY APPLICATIONS OF GAMING-SIMULATION
Robert H.R. Armstrong, Institute of Local Government, University of Birmingham, England;
Robert Hanson, Scientific Management Associates;
Richard McGinty, Project COMEX, University of Southern California;
Jim Sinopoli (and Herman Sievering), Governor's State University; *
Gini Buus, Lutheran Campus Ministry.

4. NEW DEVELOPMENTS IN TEACHING AND TRAINING
Dana Main, (Robert Stout, D.W. Rajecki, Howard Eichenbaum, Trudy Villars), University of Michigan; *
Richard Barton, University of Texas;
Judy Karshmer, University of Massachusetts School of Nursing.

SUB-GROUP MEETINGS AND FACILITATORS:

1. COMMUNITY AND PUBLIC POLICY APPLICATIONS
Facilitators: members of panel 3 above.

2. RESEARCH
Facilitators: members of panel 2 above.

3. TEACHING AND TRAINING:
A. Elementary and Secondary Education
Carl Rinne, University of Michigan - Flint;
Harriet Arnold, Florida State University

B. Urban Planning
Allan Feldt, University of Michigan;
Robert Sarly, Central Polytechnic of London;
David La Hart, Bureau of Environmental Studies, Florida

C. Health and Social Work:
Armand Lauffer, University of Michigan;
Shirley Smoyak, Rutgers University Medical School;
Judy Karshmer, University of Massachusetts School of Nursing.

D. Business

Richard Barton, University of Texas;
Myron Uretsky, New York University.

E. Military:

John Honig, Department of the Army

(*co-authors not present at the meetings are indicated in parentheses).

There were two additional types of sessions: business meetings and informal social events. The NGC business meeting drew about 40-50 people. Several important decisions were reached at that time: (1) the 1974 NGC meetings will be held in Pittsburgh, sponsored by a consortium of insittutions. Arrangements are being made by Dr. Clark Rogers, Department of Urban Affairs, University of Pittsburgh. Clark welcomes suggestions from all interested in the forthcoming meetings. (2) The 1975 meetings are tentatively scheduled for Los Angeles. It was hoped that with advance time such as this decision would provide, some of the problems of conference organizing could be mitigated. The person to contact about these meetings is Dr. Richard McGinty, Project COMEX, University of Southern California. (3) A committee was set up to investigate modes of formalizing the National Gaming Council. Incorporation, becoming a sub-group of another organization, or developing into a regional chapter (North American) of ISAGA were discussed and will be investigated by this committee. Richard D. Duke, School of Natural Resources, University of Michigan is coordinating this committee.

The ISAGA business meeting was attended by about 30 conference participants. Endorsement of the proposal to hold the 1974 ISAGA meetings in West Berlin, arranged by Margrit Kennedy, will be carried back to the European membership for final mail-vote decision. Sites for future meetings were discussed and further suggestions will be elicited from members. Finally, membership, finance, and development of the organization were explored.

Last, but surely not least important, the conference included several informal social events. Although registration for the conference did not take place until Monday morning, the meetings officially began on Sunday evening with a "games party". In accord with the argument many of us give that games are good for generating interaction between people who don't know each other, a series of games were put out on tables to help the travel-weary relax and meet old and new friends. Most of the games presented at that time were those designed for entertainment, rather than for teaching, research or policy applications. Only those games that could be left "alone" on tables for those who wished to see or play them were used; those that were to be demonstrated by their designers were saved until Monday and Tuesday evening.

Several games publishers and manufacturers donated their products for use at this party:

Parker Brothers
Salem, Massachusetts.

Kontrell Industries
Route 9
Cold Springs, New York

3M Company
St. Paul, Minnesota

Selchow and Righter Co.
Bay Shore, New YOrk

Avalon Hill Company
Baltimore, Maryland

Academic Games Associates
Baltimore, Maryland

Simulations Publications
New York, New York

We are all indebted to them for their assistance.

The other opportunity for informal gathering was at the cash-bar parties following the two evenings of demonstrations.

The total program, then, fell into place as shown in the following chart which conference participants used as a guide to what was transpiring at any given time.

EPILOGUE

Perhaps it is too soon to write an epilogue, reviewing the meetings and assessing their impact. I surely hope so, for if the program "worked" it provided no easy answers but triggered a large number of questions, gave some provisional hints about seeking the answers, and established for those in attendance a set of contacts and ties with others to help in the searches they undertake. The comments made to me during and following the conference suggest that in these terms the conference was a success.

About 120 people gathered for the meetings, wending their ways through the program, combining sub-groups where there was a desire for a broadened perspective, dividing them up where greater depth on an aspect was desired. Sub-groups had been given the task of producing State-of-the-Art papers summarizing where we were in their part of the field, and facilitators were asked to assume responsibility for preparation of these. I am sure they will be incomplete in total number, and that those that are included here will give only hints of what transpired. But this is due not only to the very limited time each sub-group had to work in, but as well to the far-ranging explorations characteristic of all those I saw. While they were extremely fruitful for those who met together, then, they were hard to summarize and present to those not present.

This summary and the epilogue portion of it would not be complete without the usual thanks and reminders that those thanked for their assistance are not to be blamed for the shortcomings! While the buck stops here, then, I must thank several people for their contributions. My first enterprise as Program Chairman was to send a letter loaded with questions to a number of friends, asking for their comments on former meetings and their suggestions for this one. Those who took the time to respond are far too numerous to list here, but their help was invaluable. Through much of the planning phase, conversations with and ideas from David Rosen, Richard Budd, and Brent Ruben, all of Rutgers University helped turn a general commitment to a working conference into an actual plan for one. My several lunches and many more telephone "testings" with Brent added much not only in content but also in belief that such a structure would work. He is responsible for the form of the preliminary announcement and call for papers, as well. As frustrations arose and concern at coordination of the multiple activities became fearful, the offers of Dana Main to assist in anything that needed doing were most gratefully received and went a long way to reassuring me that it would all work out! From the day I agreed to develop the program until the final Symposium concluded the enterprise, Richard Duke was a great source of ideas, suggestions, and support.

And of course none of this could have been more than an outline on paper without the work of Peter House, Marty Brossman, and Al Pines from the Environmental Studies Division, and of John Moriarty from our host, the National Bureau of Standards.

To all, my warm appreciation.

October 9, 1973

SUNDAY NIGHT SEPT. 16

8:00 P.M.	**WELCOME PARTY: BEER, WINE, & GAMES!** **at the Washingtonian**

MONDAY SEPT. 17

	THEORY-EVALUATION TASK-GROUP	*DESIGN TASK-GROUP*	*APPLICATIONS TASK-GROUP*
8:00–9:30	REGISTRATION, COFFEE, EXHIBITS		
9:30–10:00	OFFICIAL WELCOMES – NGC – ISAGA – CONFERENCE		
10:00–11:30	STATE-OF-THE-ART GENERAL SYMPOSIUM NO. 1: INTERNATIONAL DEVELOPMENTS IN GAMING-SIMULATION		
11:30–12:15	THEMATIC INTRODUCTION: "TOWARDS A GENERAL THEORY OF GAMING"		
12:15–1:00	LUNCH		
1:00–2:00	PANEL: THE WHAT AND WHY OF GAMING-SIMULATION: THEORETICAL BASES	PANEL: MODELS OF THE DESIGN PROCESS	PANEL: ISSUES IN GAME USE: WHAT VALUES ARE CONVEYED BY GAME DESIGNERS AND USERS?
2:00–3:00	PANEL: GENERAL PROBLEMS IN EVALUATION OF GAMING-SIMULATION	ORGANIZATION AND PLANNING OF TASK-GROUP ACTIVITIES & SUB-GROUPS	ORGANIZATION AND PLANNING OF TASK-GROUP ACTIVITIES AND SUB-GROUPS
3:00–3:30	COFFEE BREAK		
3:30–4:30	ORGANIZATION AND PLANNING OF TASK-GROUP ACTIVITIES AND SUB-GROUPS	SUB-GROUP MEETING: General dimensions of design | Computer–based simulation | Unstructured and game-generating games	PANEL: USES OF GAMING-SIMULATION FOR RESEARCH
4:30–6:00	ISAGA BUSINESS MEETING		
6:00–8:00	DINNER		
8:00–10:00	GAME DESCRIPTIONS AND DEMONSTRATIONS		
10:00	CASH BAR COCKTAIL PARTY		

TUESDAY SEPT. 18

9:30–11:00	STATE-OF-THE-ART GENERAL SYMPOSIUM NO. 2: PRESENT AND FUTURE RESOURCES IN GAMING-SIMULATION		
11:00–12:30	PANEL: NEW FINDINGS FROM EVALUATIVE STUDIES	SUB-GROUP MEETINGS: Designing interactive social simulations | Computer based simulations | Unstructured game-generating games	SUB-GROUP MEETINGS TEACHING TRAINING: Elem. Sec'y Ed | College Univ. Social Science | Urban planning | Health Social Work | Business | Military | Community public policy | Research
12:30–1:30	LUNCH		
1:30–2:45	SUB-GROUP MEETINGS: THEORY: Learning communications | Systems theory, operations research EVALUATION: Classroom, training | Planning research	PANEL: CONCEPTUAL MODELLING AND VALIDATION OF MODELS	SUB-GROUP MEETINGS: CONTINUED AS ABOVE
2:45–3:15	COFFEE BREAK		
3:15–4:30	SUB-GROUP MEETINGS CONTINUED AS ABOVE	SUB-GROUP MEETINGS Designing interactive social simulations | Computer-based simulations | Futures modelling	PANEL: PUBLIC POLICY & COMMUNITY APPLICATIONS OF GAMING
4:30–6:00	NGC BUSINESS MEETINGS		
6:00–8:00	DINNER		
8:00–10:00	GAME DESCRIPTIONS AND DEMONSTRATIONS		
10:00–	CASH BAR COCKTAIL PARTY		

WEDNESDAY SEPT. 19

9:30–11:00 11:00–12:30	SUB-GROUP MEETINGS: THEORY: Learning, communications, etc. | Systems theory, operations research EVALUATION: Classroom, training | Planning, research	SUB-GROUP MEETINGS: Student designed games | Pragmatics of game development: costs & dissemination | [illegible]	PANEL: NEW TEACHING-TRAINING DEVELOPMENTS SUB-GROUP MEETINGS: TEACHING–TRAINING (SAME AS TUESDAY) | Community, Public Policy | Research
12:30–1:30	LUNCH		
1:30–2:30	FULL TASK-GROUP SUMMARY MEETING: THEORY – EVALUATION	FULL TASK-GROUP SUMMARY MEETING: DESIGN	FULL TASK-GROUP SUMMARY MEETING: APPLICATIONS
2:30–3:00	COFFEE BREAK		
3:00–5:00	STATE-OF-THE ART GENERAL SYMPOSIUM NO. 3: DEVELOPMENTS AND PROSPECTS IN THEORY-EVALUATION, DESIGN, AND APPLICATIONS OF GAMING		

TOWARD A GENERAL THEORY OF GAMING

By Professor Richard D. Duke
Environmental Simulation Laboratory
School of Natural Resources
The University of Michigan
Ann Arbor, Michigan 48104

I. THE PROBLEM

Humankind is a little harried of late. The naked ape barely blinked only to discover that his animal being has moved from the cave to the moon with precious little time for adjustment, measured in evolutionary terms. It is difficult to derive a valid "alienation index" for a society, perhaps impossible for different points in historical time. None-the-less, evidence abounds that all is not right with western civilization as it is currently structured; further, the situation has deteriorated markedly in the past quarter century. The tune-out, drop-out, cop-out syndrome is ever apparent although the recurrent waves of enthusiasm (e.g., populist activity in environmental concerns) give reason to believe all is not lost. But even in such cases where enthusiasms are high and a general sense of urgency and responsibility exists at the level of the individual, there is pervasive frustration. The individual needs to be part of those processes affecting his life, but is currently devoid of any effective means to alter things or join the dialogue about potential change. This situation reveals some dimensions of life today that were not previously true:

- The problems of today are infinitely more complex, involving systems and interacting sub-systems that go beyond normal human ken and which do not yield to conventional jargon or traditional forms of communication.
- The sheer quantity of individuals who want to be effectively part of the dialogue is large and growing rapidly.
- There is a growing personal urgency because the solutions pursued today constitute a more pervasive intrusion in the individual's life. (In earlier times the king's men may have come periodically for the taxes, but in the interim period, life was constrained only by the elements and by whatever circumstances might exist within a personalized clan; today, the Internal Revenue Service comes every week and unknown Big Brother, in a thousand ways, constrains the daily actions of our lives.)

This situation, of course, is not new. Without too much difficulty man's struggle for the personalized control of his life can be traced through the Magna Carta and the decline of the king's power to the Parliament to the Declaration of Independence and resulting constitutional governmental forms (whose painfully won gains are now threatened by a technical aristocracy, the high priests of 1984). Even the great urban political bosses performed a valid personalizing influence buffering the citizen from the emerging systems and technologies that must control his world (sadly, only vestiges of this humanizing function remain, witness the light years between the individual and national politics--can it be other than Alice in Wonderland with spy versus spy, body counts from a constitutionally non-existent war, complexity of domestic programs that boggle the expert mind while dominating in strict inverse relation, the lives of the least able citizenry)?

At the very moment when man seemed to have garnered the power to control his personal destiny by his own hands, he has been caught unawares in the grinding pinchers movement of the complexity of societal survival in modern times and the inevitable technological response. This crunch has been on its way since the industrial revolution, but its very rapid progression was precipitated by World War II, in particular by the spin-offs in computer technology and the resultant elaboration of the concept of "systems" and related, evolving technologies. Now the high priests of technology speak only to the high priests of technology, God is dead, and the citizen, no matter how strongly motivated, can hardly get a word in edgewise!

Problems of the management of modern western society (and in a particular sense the great urban centers) have generated the modern equivalent of the biblical Tower of Babel. To unravel the present "want structure" in human terms, to harness appropriate technologies and to manage a successful and continuous response in an on-going societal context generates a communication net (non-net?) that is truly unimaginable and certainly unmanageable. Society's failure to respond to individual need is, in large part, a communication problem.

The naked ape waved and grunted and we do little better. He lived in a relatively simple world, and over many centuries developed what have been viewed as sophisticated languages but which in reality are only involved extensions of sequential form (including not only a written and spoken English, but also the sophisticated artificial languages of mathematics, computer programming, musical notation, etc.) to deal with this non-complex environment. The naked (now harried) ape of today still employes these simple sequential tongues, but in a world several magnitudes more complex, it leaves him speechless. The highly constrained and sequential languages of the past, and their related technologies (even in their highest forms) fail at conveying gestalt, and so the complexity of today cannot be comprehended or communicated except with the greatest of effort, and then only by a new elite. For example, consider our great urban centers as they exist today, multi-systems within multi-systems, alternative upon alternative presenting an incomprehensible, many futured state(s); the tongues of many men, some unborn, in migrant and out, being daily rearticulated as perceptions of the possible change; a great multi-faceted sphere of complexity that cannot be managed, but must be. Societal response, predictably, has been of four concurrent dimensions: false dichotomies, professional elitism, increasing dependency on technology and gigantism. The inevitable, but false dichotomies appear first: pare out of the total fabric of society some element of great urgency; if we can neither understand nor solve the totality, we can solve some definable part, <u>no matter that other evils are encountered, the least of which may be inefficiency, the most dangerous irrelevancy</u> (witness "education" as a system currently practiced in the inner city). As the Bureaucracy (Education, Transportation, Health, Housing, ad nauseam) transforms life into disconnected cells, society loses not only in the more obvious negative harvest (the "solution" of Urban Renewal, originally conceived as a simple-minded clearance problem, now yields to more sophisticated approaches at a cost of two decades only to be replaced by the "solution" of an "interstate highway system" rather than an "interstate transportation system"); but, also, in a positive sense since such dichotomy leaves little room for subtlety of solution.

And with the dichotomy came the armies of the professional elite and with them their empires, and the resulting gigantism dwarfs and smothers the citizen. The fiction of alternatives (witness State Highway Engineering) may seduce the generalized citizen, but the poor beggar in front of the bulldozer soon discovers the moment of truth. And as he turns into the jaws of this giant beast trying to locate some isolable component unit that will be responsive, he is put down by the elites--the professional who quite literallly speaks another language and he is put off by a technology that appears antihuman; his only alternative is to join together with fragmentary bands to throw slingshots at the giant. And, occasionally, their aim is true! First one, then another, public scheme is beat back not to be replaced with positive alternatives, but to a frustrated stand-off where the great urban administrations survive through non-action and the great creaking structure grinds through time, the moans of unresolved needs and of endless counter-productive conflict emanating from the incongruous mass.

And who is to comprehend it all? Or who is to speak of it all? And to whom? Is there any remote possibility of establishing a real dialogue about this multi-faceted dynamic gargantua, even among the elite, substituting future time-frame for future time-frame in advance of reality, permitting positive management to replace a negative reactionary reality? And is there anyway to enlarge the dialogue to include the activist citizen or someone who might conceivably be called his "representative" in that he transmits a personal translation of ideas for his limited and personally known constituency?

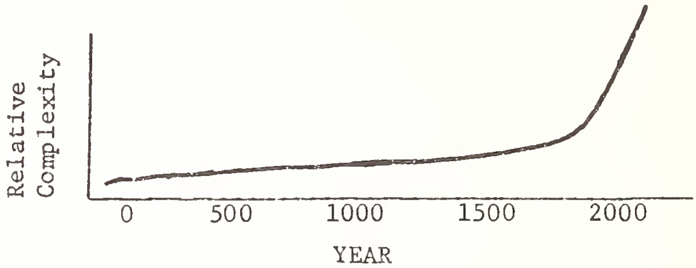
Of course not, not if we insist on restricting ourselves to the languages of the caveman.

But there is hope that the possibility for a quantum jump exists; that communication can move from its rigid and limiting sequentiality to a gestalt mode, and that this supra-language can be used as a simultaneous translation for our modern Tower of Babel.

II. ESTABLISHING THE NEED FOR FUTURE'S LANGUAGE

"Future Shock" has become part of the popular lexicon. Alvin Toffler in 1970 introduced the concept in a book by that name in which he stresses the death of permanence and the coming of the age, not of Aquarius, but of transience. The book documents in detail his thesis that the world of tomorrow will be significantly different from the world of yesterday along many dimensions. Toffler quotes from Kenneth Boulding: "as far as many statistical series related to activities of mankind are concerned the date that divides human history into two equal parts is well within living memory" . . . "The world of today . . . is as different from the world in which I was born as that world was from Julius Caesar's. I was born in the middle of human history, to date, roughly. Almost as much has happened since I was born as happened before."

The temptation to document, here, the proof of this accelerated change and its impact on our lives; but the thesis will either be accepted or rejected without elaboration since it is a familiar one. To place its significance to gaming in proper perspective I would like to allude to a simple graph. The horizontal axis would represent centuries starting perhaps with the year 0 in our current system of counting; the vertical column would represent an index, however, obtained, which would attempt to convey complexity, transicence, and rate of change confronting the typical citizen. Using a logrithmic scale a curve is plotted which attempts to illustrate this change (perhaps the number of new things which must be assimilated in the lifetime of a given citizen). The curve would start in the extreme lower left hand corner and be virtually a straight line with a slight incline upward, barely perceptable, until perhaps 1900; incremental jumps might be noted at the time gunpowder was introduced and certainly as the industrial revolution impacted on society. The curve turns vertical during the period 1900-1940 with a sharp increase during the period of World War II. Subsequent to World War II the curve would be increasing at a near vertical rate implying change flowing on change at a totally unprecedented rate. Curiously, a number of authors have independently noted World War II as being the approximate time of the pivet from the trend line through antiquity to the modern trend line.



Virtually all our language forms have come from antiquity and have sufficed, in spite of their sequentiality, because they rely heavily on analogy and the analogies employed are predicated on historic circumstance which is not expected to change, except by minor adjustments through time. Note that the curve in the post World War II period, a situation far more involved, particularly in the several dimensions of complexity, future orientation, thoughtful consideration of alternatives, and the inevitable recognition of the nature of systems and inter-locking sub-systems which are affected. Necessity is the mother of invention, and the post World War II period has shown many innovations in communication which attempt to deal with this communications problem; each relect an attempt to convey gestalt, or at least to excape from the harsh burden of strict sequentiality of the written and spoken language forms. If one were to plot the advent of gaming as indicated by the new games which appear in the various cataloging efforts the curve mimics rather accurately the curve of accelerated change with perhaps a 10 or 15 year lag. This reflects, in my judgment, a spontaneous solution, "gaming," by many people in many problem situations to the problem of developing a gestalt communication form. In short we have a new language form, a language form which is "future" oriented. If this premise holds, to date we have seen no general statement or theory which would explain the wide diversity of materials which appear as games, or which might guide the neophyte in efforts to develop effective games for their own communication purpose.

The need for conveying holistic thought, or gestalt, is urgent; the coming decade will increase this urgency considerably. Perhaps the most trenchat statement on this need is by R. F. Rhyne in an article "Communicating Holistic Insights" published in Fields Within Fields Within Fields. While describing the need for holistic communication Rhyne states "There is a Macro problem, an inter-weaving of adverse conditions that is more extensive, more richly structured by interior lines of interaction, and more threatening than any circumstance faced before by all mankind." Rhyne's article was formuated "to stimulate exploration of the means whereby appreciations of complex wholes may be more quickly and more reliably told to others." He, too, rejects our ancestral language forms as being inadequate to the task and argues that new forms must be invented. Arguing that decision is a gestalt event and not a logically determinable process, he believes that the citizen or the policy researcher or other decision maker must first comprehend the whole, the entirety, the gestalt, the system, before the particulars can be dealt with. Rhyne suggests a variety of approaches to this problem and alludes to games as having a particular potential.

We learn through games because, if properly designed, they represent abstract symbolic maps of multi-dimensional phenomenon which serve as a basic reference system for tucking away the bits and pieces of detail which are transmitted and in particular by assisting in the formulation of inquiry from a variety of obtuse angles or perspectives which are meaningful to the individual making the inquiry and which can only be transmitted through an "N"-dimensional, abstract, symbolic-mapping procedure. If the prior observations on the character of change in the world since World War II are valid, they could perhaps be summarized as follows: prior to World War II the need for pragmatic information and fact, learned by rote, was imperative; in the new era the need is urgently for the acquisition of heuristics or a flexible set of highly abstract conceptual tools which will let the participant view new and emerging situations, having no precedent, in a way that permits comprehension. We learn through games, then, because it is a relatively safe environment which permits the exploration of many perspectives chosen by the individual, expressed in the jargon of the individual, and subject to fairly prompt feedback in "what-if" contexts. These concepts gain strength when reviewing the work of Moore and Anderson in "Some Principles for the Design of Clarifying Educational Environments" as they conduct research on learning environments. Curiously enough, they pinpoint the time of change in society as being dramatically correlated with the decade of the forties. Properly designed, games have a strong basis in learning theory, which supports their potential as a communication form.

The simultaneous invention of games of a wide diversity of subject matter and technique is a response to a felt need for an improved communication form to deal with problems of gestalt or holistic thought. Just as the folk models alluded to by More and Anderson emerged in a societal context as needed, games become a modern equivalent.

III. WHAT IS A FUTURE'S LANGUAGE

For the moment, let me identify seven basic requirements that must be met by any future's language:

1. Ability to convey gestalt or holistic image.
2. Permit the specification of detail at any appropriate level, in the context of the holistic image.
3. Structured to permit the pulsing of specific, tangible inquiries or alternatives to permit correlation with the holistic image and any significant detail.
4. The ability to display, make explicit, or permit the recording of explicit linkages between major segments of the holistic imagery: the creation of an awareness of feedback.
5. A non-elitiest, universal possibility for use; a basic catholicity of design.
6. A future orientation (implying <u>any</u> time frame past or future <u>other</u> than the present).
7. They must be basically transient in format to permit the restructuring or more careful articulation of the problem as viewed by those participating.

Clearly, gaming has not pre-empted as <u>the</u> future's language. However, if certain rules, concepts, or principles are employed consistently, the game product can certainly qualify in a wide variety of situations.

IV. <u>GAMING--THE FUTURE'S LANGUAGE</u>

There are two charts attached. The first, "conveying complex systems," formulates the rational for the game as a supra-language. A language is defined as a symbol set and the conventions governing their use. A supra-language is defined as a hybrid consisting of one or more conventional languages and one game-specific language. The game-specific language implies the need for the development of an explicit symbol set appropriate to the context of the game as well as the rules governing the use of these new symbols. In game design, careful attention must be devoted to the precise formulation of this game-specific language and care must be taken to convey it thoughtfully and early on to the game participants. Only then will they share a vernacular which permits them to jointly share an investigation of a complex system. The game, then, which has as its objective conveying complex reality, has as its result the conveyance of an imagery which may be close to, or distant from, reality; therein lies an excellent device for evaluating a game after construction. The second chart entitled "Gaming--The Future's Language" is a consolidation of the elements which are being advanced as the logical components of a general theory of gaming and game design.

Time will not permit a careful exposition but the main theme can be advanced. First, the character of the problem must be stated in communications terms. This problem must be interpreted against the "Communications Continuum" to verify that a less specific and therefore less costly communication form cannot be employed in lieu of a game. If thoughtful review indicates that the gaming medium is appropriate we then advance to the game design process, center page. Most game designers approach their problem as though it were a confused multi-dimension simultaneous equation. The result is an elongated process and sometimes a confused prodeuct. The game design process is itself relatively straight forward and may be somewhat more or less complicated than the illustration might suggest depending on the problem at hand and the character of the game being developed. None-the-less, the game designer is well advised to make a preliminary pass through the entire process at least intellectually to sort things out before attempting game construction. The game components in the lower left hand side of the chart have an approximate correlation with grammar in the context of spoken or written English. In particular, the symbolic structure employed is a very significant decision on the part of the game designer. If it is too complex the audience may be lost; too simple, the audience put-off or not able to comprehend the nature of the basic system. If the symbolism employs terms in conventional use in an attempt to convey new ideas there will be a built-in distortion which will slow the progress of the game and which may or may not ultimately be overcome. Games are iterative in nature and the procedures for play must be clear both to the game designer and to the participants. Mechanics are somewhat flexible and should be differentiated from rules which must be constant. Scenario, of course, implies a substantive content and may be a replaceable element in the instance of frame games.

The repertoire of techniques illustrated in the lower right hand corner is intended as a systematic strucutre which will enable the neophyte game designer to evaluate or interpret existing games in a systematic fashion. The particulars of any given game will vary tremendously in style, technique and paraphernalia; none-the-less, any game can be interpreted through the characteristics which are presented.

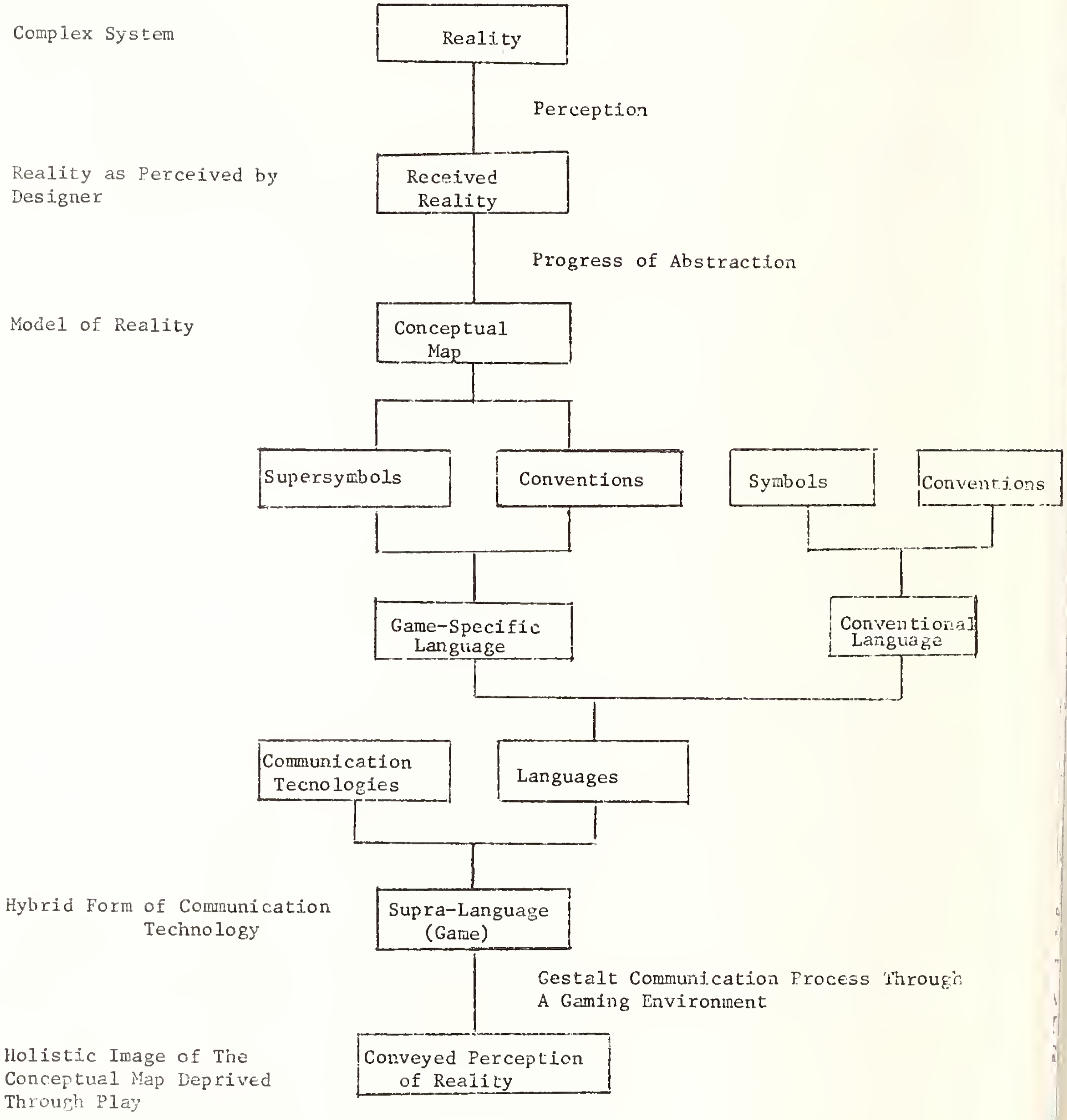
V. CONCLUSION

Finally, the upper right hand corner illustrates interpretive criteria. The suggestion is made that the time is at hand for gamers to adopt a set of conventions which require the designer to present in orderly fashion a basic set of information which would be useful to the potential user as a way for speculating on the character of the game prior to play. Contrast the conventions currently in use in conjunction with "book" with the enormous disarray of "game". The consistent format of "book" which has emerged over a long period permits the ready and quick interpretation of the book for its potential to the user; the average game today is a morass which is unintelligible to the potential user until completion of play.

Finally, some basis for evaluation should be formulated by the game designer and explicitly included in each game product. This evaluation would require an explicit statement on the part of the designer explaining the reality which the game addresses, and explicitly an abstracted form of that reality (conceptual map) as interpreted by the designer in the construction of the game.

These thoughts are offered in the most tentative fashion, in the hopes that they will prompt a dialogue leading toward the development of a general theory of gaming.

The want of an organized, generalized perspective which adequately accounts for the incredible diversity of games is and will remain an impediment to their intelligent use. While several perspectives have been in vogue, they inevitably account for only a small segment of what we generally refer to as games. The time has come to wrestle with this problem.


Complex System
Reality
Perception
Reality as Perceived by Designer
Received Reality
Progress of Abstraction
Model of Reality
Conceptual Map
Supersymbols
Conventions
Symbols
Conventions
Game-Specific Language
Conventional Language
Communication Tecnologies
Languages
Hybrid Form of Communication Technology
Supra-Language (Game)
Gestalt Communication Process Through A Gaming Environment
Holistic Image of The Conceptual Map Deprived Through Play
Conveyed Perception of Reality

FACILITATOR'S STATEMENT

THEORY AND EVALUATION TASK GROUP

THEORY AND EVALUATION

IN THE FIELD OF EDUCATION WE ARE FAST MOVING TO A POSITION OF TEACHING TECHNICAL SKILLS AND HARD OBJECTIVE EVALUATION. JUDGING TEACHING COMPETENCIES AND THE WRITING OF BEHAVIORAL OBJECTIVES APPEARS TO BE RESTRICTIVE DEVICES UPON BROAD AND CREATIVE AVENUES OF LEARNING. IN THE MILIEU OF THE CLASSROOM THIS THRUST IS TAKING THE FORM OF SHORT EVALUATIVE MEASURES WITH A DESIGNATED SCORE FOR MOVING FROM ONE COMPLETED AREA TO ANOTHER. INHERENT IN THIS SYSTEM ARE SKILLS FOR SURVIVAL. LEARNING TO REACT FAST IN A LEARNING SITUATION, SKIMMING, SCANNING AND ANALYTICAL READING SKILLS, LESS INTERACTION WITH THE MATERIAL ITSELF AND MAXIMUM REWARDS PLACED UPON RIGHT ANSWERS SEEM TO BE THE MODE OF THE DAY.

FURTHER, THE TEACHING SKILLS THAT WILL HAVE TO BE ACCOUNTED FOR IN THIS WAY (WRITING DOWN EXACTLY WHAT THE TEACHER INTENDS TO ACCOMPLISH AND THEN TESTING TO SEE IF IT WAS ACCOMPLISHED) CANNOT BE SKILLS AT A LEVEL WHERE MUCH TIME IS DEMANDED FOR LEARNING NOR WILL THEY BE RELEGATED TO THE AFFECTIVE DOMAIN OF DECISION MAKING SKILLS. FROM PRESENT DATA AVAILABLE IT APPEARS THAT MOST TEACHING WILL REGRESS TO TECHNICAL SKILLS AT THE KNOWLEDGE AND COMPREHENSION LEVEL.

IT IS IMPERATIVE THEREFORE BECAUSE OF THE ROLE OF GAMES IN THIS SCHEME THAT AT THIS TIME WE ALSO MAKE A DECISION ABOUT THE USE OF THEM IN THE CLASSROOM. TO USE THEM IN THE TECHNICAL SENSE WHERE REWARDS ARE IMMEDIATE AND THE MECHANICAL FEATURES OR HOW TO PLAY THE GAME ASSUMES TOO MUCH IMPORTANCE IS CERTAINLY ONE USE FOR THEM. THIS MODE IS USUALLY ACCOMPANIED BY STRICT RULES AND CONCISE STRUCTURE. THE INPUT OF THE PLAYER IS ONLY THROUGH THESE AVENUES AND THE OUTCOMES PRESCRIBED FOR HIM.

ANOTHER WAY TO MAKE USE OF GAMES AND SIMULATIONS IS TO APPLY THEM SO AS TO MAKE A MINIMAL STRUCTURE TO THE EVENT SO AS TO MAXIMIZE INPUT AND THEREFORE OUTPUT BY THE PLAYER. ENDS IN GAMES WHERE DECISION MAKING IS A CULMINATING ACTIVITY AND ANY LOGICAL DECISION IS GIVEN WORTH AND THAT DECISION IS NOT DETERMINED ENTIRELY BY THE GAME BUT BY THE PERSON PLAYING THE GAME, IS A MOVE IN THIS DIRECTION.

THE QUESTION EMERGES AS:

1. ARE GAMES BEING USED AS A RESTRICTIVE OR EXPANDING MODE OF LEARNING?

2. ARE GAMES BECOMING A TECHNOLOGICAL DEVICE THAT ENHANCES THE OBJECTIVE TECHNOLOGICAL THRUST SO PRESENT IN EDUCATION TODAY?

RICHARD A. SCHUSLER
School of Education
Dept. of Curriculum & Instruction
Kansas University
Lawrence, Kansas, USA 66044

EVALUATION: CLASSROOM USES: TRAINING
PLANNING AND RESEARCH USES

Jay C. Thompson, Jr.
Area of Curriculum and Instruction
Teachers College
Ball State University
Muncie, Indiana 47306

Charles H. Postma
Division of Education
Ashland College
Ashland, Ohio 44805

Facilitator's Statement

The effectiveness of simulation and gaming in achieving cognitive and affective objectives is uncertain. Results of the research studies which were conducted during the 1960's and early 1970's that focused attention on the achieving of cognitive and affective learning out comes were inconclusive.

Educators presently have considerable expertise in cognitive measurement of subject matter acquired in traditional ways. The measurement of knowledge and concepts is only one aspect of evaluation, and probably not the most important. However, at this time affective outcomes in classrooms are not measured adequately. Many classroom simulations and games are thought to have significaant affective components and/or outcomes. Failure to adequately assess these outcomes is a problem that must be faced by professionals interested in evaluation of simulation and gaming techniques.

To measure students' affective learning outcomes, three evaluation components are essential:

1) The evaluator should determine what pupils judge is happening to them because they participate in predetermined activities. Principles of learning suggest that what a person perceives as important, is important to him. Therefore, it is necessary in the evaluation assessment to attempt to determine what students judge is happening to them. Pupils may need instruction and practice at self analysis.

2) The evaluator must attempt to determine what teachers and other professional personnel do that has an impact on pupils. Ryans, Hughes, Travers, Flanders, and others contend that a method for measuring a program's effectiveness is to measure what is judged to be good teaching.

3) The important cognitive and affective experiences which exist outside of organized knowledge must be measured. A pupil learns to seek or avoid intellectual activities on the basis of whether he finds them rewarding and challenging or obscure and irrelevant. A student partially decides his own worth on the basis of the value teachers and other pupils extend to him.

The classroom implications for simulation and gaming from such components as these must be analyzed; instruments must be designed to increase the effectiveness of evaluation for cognitive and affective outcomes in simulation and gaming. Affective outcomes in classrooms are of great importance. Too little attention has been focused on this outcome. This position is not to imply that cognitive outcomes are of lesser importance; but that educators have spent considerable time and effort analyzing such outcomes, frequently at the "expense" of affective outcomes in which we have too little skill at measurement.

EVALUATION SUB-GROUP

FACILITATOR'S STATEMENT:

SIVASAILAM THIAGARAJAN

Coordinator, Instructional Development Laboratory
Center for Innovation in Teaching the Handicapped
Indiana University
Bloomington, Indiana, USA 47401

BEHAVIORAL OBJECTIVES, SIMULATION/GAME DESIGN AND GOAL-FREE EVALUATION

As an instructional developer brought up on specific behavioral objectives and criterion-referenced evaluation, I have always had ambivalent feelings about the design and evaluation of simulation/games. It has been a frustrating experience to balance the attainment of predetermined objectives and elegance of simulation/game design. The final form of most creative simulations/games we produced bore very little resemblance to the initial set of objectives, suggesting two alternative approaches: One was to abort the simulation/game and come up with another whose outcomes matched the objectives more closely (but usually less interestingly). The second was to dump the objectives and derive another set from the simulation/game itself. Usually we chose the latter procedure, not without a sense of guilt.

While in search of conceptual clarification, I came across Scriven's (1972) concept of goal-free evaluation (GFE) and became intrigued by its applicability to the evaluation of the instructional effectiveness of simulation/games. Basically, in GFE an independent evaluator sets out to identify the outcomes of the simulation/game without being told what the designer's goals are. Once the outcomes are identified, they are compared with the needs--of the consumer, the society, or the subject-matter discipline--to determine their importance. Scriven draws an analogy between double-blind experiments in medicine and GFE in education and points out that increased objectivity results in both cases. Specifically, in the evaluation of simulation/games, the goal-free evaluator is neither misled by the grandiose goals, nor blinded by trivial behavioral objectives. By matching the outcomes of the simulation/game with the needs of a larger segment of society, the evaluator successfully integrates what usually is a two-step process of evaluating the validity of the goals and the efficacy of the game. An independent evaluation agency--perhaps under the auspices of NGC--can be set up to undertake such summative evaluation and report to the consumers what the product really does rather than reprint the claims of the producers.

Formative use of GFE results in useful feedback for the revision of the game. I am not recommending that the design of simulation/games should be a purposeless activity. The designer should have a purpose beyond the mere play of the game, but this need not be "set in concrete."

Once he comes up with a reasonable prototype of the game, it should be evaluated by an impartial expert who, uncontaminated by a statement of its goals, is left to identify the actual outcomes. If these outcomes match the designer's goals, his mission is accomplished. If they do not match, but appear relevant and important in fulfilling some felt need in the field, the designer has new leads and an uncompleted task. He may develop the simulation/game to exploit and strengthen its unanticipated effects and reconsider alternative instructional approaches to the attainment of his initial set of objectives. GFE thus elevates the process of game design into a more creative act.

EVALUATION
FACILITATOR'S STATEMENT: PATRICIA Y. MARTIN

Department of Social Work and
Institute for Social Research
Florida State University
Tallahassee, Florida, 32306

James Coleman(1969)has noted recently that social simulation games are superior to laboratory experiments for two major reasons. First is the fact that laboratory experiments ordinarily abstruct a much smaller part of a social process for study, with the result that the activity is non-self-sustaining and non-self-regulating. By contrast, in a social simulation game, the players themselves constitute a micro-social system, which regulates itself without interference from the outside. Second, Coleman notes that in laboratory experiments, the motivation for action must ordinarily be imposed from outside, through directives from the experimenter. In social-simulation games, however, the motivation arises as an intrinsic aspect of the miniature social system. Specifically, the mark of a good game ". . .is that the individual goals which are induced by the rules bring about action which results in the system's functioning--just as the mark of a good organization is that in which individuals in satisfying their own goals contribute to the functioning of the social organization" (p.102).

Coleman's comments raise a number of issues worthy of serious consideration by gamers interested in evaluation--whether for teaching, training, planning, or research purposes. A number of them are as follows.

1) To what extent do our games actually "shape" behavior? That is, is behavior genuienly "induced" by game rules and goals or do games merely provide a forum for "acting-out" by the individuals involved of their various personal preferences, inclinations, and so forth? Is the extent to which behavior is shaped by the game constant for all rounds of play, or does it vary?

2) Should social-simulation games aim at "teaching": (a) <u>strategies</u> of knowledge acquisition (or of social interaction process, etc.) or (b) <u>substantive content</u> about some topic, or (c) both? Are the evaluative methods appropriate for one of these end-products suitable for both?

3) In order to secure evidence of true change in our subjects due to actual game-play, should we:
   a) employ pre and post measurements, to avoid claims of spuriousness?
   b) devise <u>precise-enough</u> game-scoring methods to allow players to serve as their "own controls"? (that is, if scoring is precise enough to reflect a given strategy, then subjects' can serve as their own controls by comparing later scores with earlier ones.)

4) which aspect of a gaming-model has the most potent impact on results of game-play: (a) rules of the game, which specify resources, rights, limits, etc., or (b) goals, the ends toward which behavior is aimed? Should more attention be given to this question?

5) As games become more isomorphic with reality--and thus, more complex--what are the attendant problems in evaluation of outcomes?

SUB-GROUP TITLE: THEORY AND EVALUATION
FACILITATOR'S STATEMENT:

By Steven H. Woolard
Department of Science & Human Affairs
College of Education
The Florida State University
Tallahassee, Florida 32306

What do simulators look for when evaluating a simulation game? How good of an evaluator are you? Below is a test designed to measure your "Evaluation Know-how."

DIRECTIONS: Circle "T" if you believe the statement to be true. Circle "F" if you believe the statement to be false. After completing the test, check your accuracy by using the key at the bottom of the last page. Calculate your score and rate yourself by using the following scale:

13 - 12	You deserve a $1000 bonus
11 - 10	You deserve a $400 raise
9 - 8	You deserve a loss in pay
7 or Below	You're fired!

True	False		
T	F	1.	Isomorphism is the most significant component in any evaluation design.
T	F	2.	If the behavior of participants in the simulation-game does not conform to the conceptual model, then the model, not the simulation, needs revising.
T	F	3.	Too many rules in a simulation-game confuse the players; so the fewer the rules the better.
T	F	4.	Player behavior in a learning simulation-game is shaped primarily by the rules; so the rules should be clear and concise.
T	F	5.	If participants learn from the simulation-game, then the simulator has accomplished his chief purpose.
T	F	6.	Simulation is an acceptable scientific technique, if it can be proven that the simulation is highly isomorphic to the conceptual model.
T	F	7.	It is <u>not</u> important for participants to learn the model in a learning simulation-game.

T F 8. If in a pre-post-test analysis there is a significant change in the participants' attitude toward the subject matter of the simulation, the simulation-game is a success.

T F 9. If behavior in the simulation-game coincides with the predicted behavior in the model, then the simulation is valid.

T F 10. When evaluating a simulation, the relationship between motivational factors, such as interest satisfaction, coping, achievement motivation, and cognitive growth, and performance is of little consequence.

T F 11. When evaluating their simulation-game, most simulators are not concerned about applying carefully developed criteria to check validity.

T F 12. Most simulation-games do not measure up to generally acceptable criteria of validity.

T F 13. High fidelity is a desirable quality in a simulation-game.

KEY

1. T
2. T
3. T
4. F

5. T
6. T
7. F
8. T

9. T
10. F
11. F
12. T
13. T

THEORY AND EVALUATION TASK GROUP

SIMULATING A MODEL OF PERCEPTION TO SHAPE PROBLEM RECOGNITION BEHAVIOR

Steven H. Woolard
Department of Science and Human Affairs
College of Education
The Florida State University
Tallahassee, Florida 32306

Many simulations available in the public market place today focus on one or more aspects of social theory. Relatively very few deal specifically with theories and models of the psychological world. What follows is a brief expository and descriptive statement that centers on the realm of psychology.

Introduction

Proponents of reflective inquiry and problem solving have examined the logic underlying these processes. Little attention has been devoted, however, to one of the initial steps in such activity--recognition of a problem. This recognition, as delineated in this paper, involves the perception of incongruity. Rather than describing perception as mere reaction to sensory stimuli, as conventionally treated, this paper will explore the concept from the stimulus as well as the behavioral perspective. Therefore, this paper has a three-fold purpose; 1) to set forth a theory of perception as one explanation of how this recognition occurs; 2) to describe a prototype simulation as a means of empirically testing the theory; and 3) to report initial findings of field tests of the prototype.

The Theory and Model

To many educational theorists John Dewey's model of reflective thinking stands as an exemplar in the field of inquiry and problem solving.[1] Outside of the domain of reflective inquiry, but yet an integral part of the model, is a pre-reflective stage called problem recognition. Problem recognition refers to the perception of a situation as puzzling or problematic.[2] Since this stage appears to be a crucial initial component of all inquiry and problem solving activity, the question is raised: how does this perception take place?

Jerome Bruner's hypothesis-theory of perception has provided at least one explanation of behavior during problem recognition.[3] The basic theory can be separated into three parts.

Phase 1	Tuning Hypothesis
Phase 2	Information Input
Phase 3	Confirmation/Infirmation

Fig. 1

During Phase 1 the individual confronts stimuli with a hypothesis that "tunes him in" on what to expect. This "Tuning Hypothesis" represents an expectancy about an anticipated event. At the same time there is a tendency to "tune out" any part of the stimuli not relevant to the hypothesis. For example, in an experiment by Bruner and Postman, individuals were shown a trick card (a red ace of spades) under a tachistoscope.[4] Several individuals continued to identify the card as a black rather than a red ace of spades.[5] These individuals had "tuned out" any discrepancy between their expectations and what actually appeared.

In Phase 2, information input, the individual selects from the stimulus certain information or cues which are used to confirm or infirm the tuning hypothesis or expectancy. These cues are fitted against the characteristics of an existing set of percepts. A percept is an abstraction used to organize sensory experiences, and includes those meanings and understandings which the perceiver attributes to it. The color red, a door, and a man are examples of percepts, and may be maintained as part of an individual's repertoire of percepts. In the experiment described above individuals used color and shape of the stimulus as cues which were fitted against an existing percept--ace of spades. Because the discrepancy between expectation and what actually appeared under the tachistoscope was "tuned out", confirmation of the expectancy occurred in Phase 3.

From the basic theory evolved a model that could be operationalized in the form of a simulation.[6] The model provided not only the form but also the functions to be replicated in the simulation, and helped determine the type of media that was needed. The model appears below in diagram form.

Drawing on much of Bruner's theoretical analysis, the model of perceptual readiness denotes a process of organizing and categorizing stimuli according to an existing set of percepts. As depicted in the model, this process involves a four-part cue-utilizing strategy where stimulus cues are linked inferentially with a set of percepts. Cue-searching occurs, however, unconsciously unless the event is low in probability and/or the fit between stimulus cues and specifications of a set of percepts is imprecise. For example, in the trick card experiment the red ace of spades was not a typical expectancy, and the fit between the stimulus and the individual's category for the

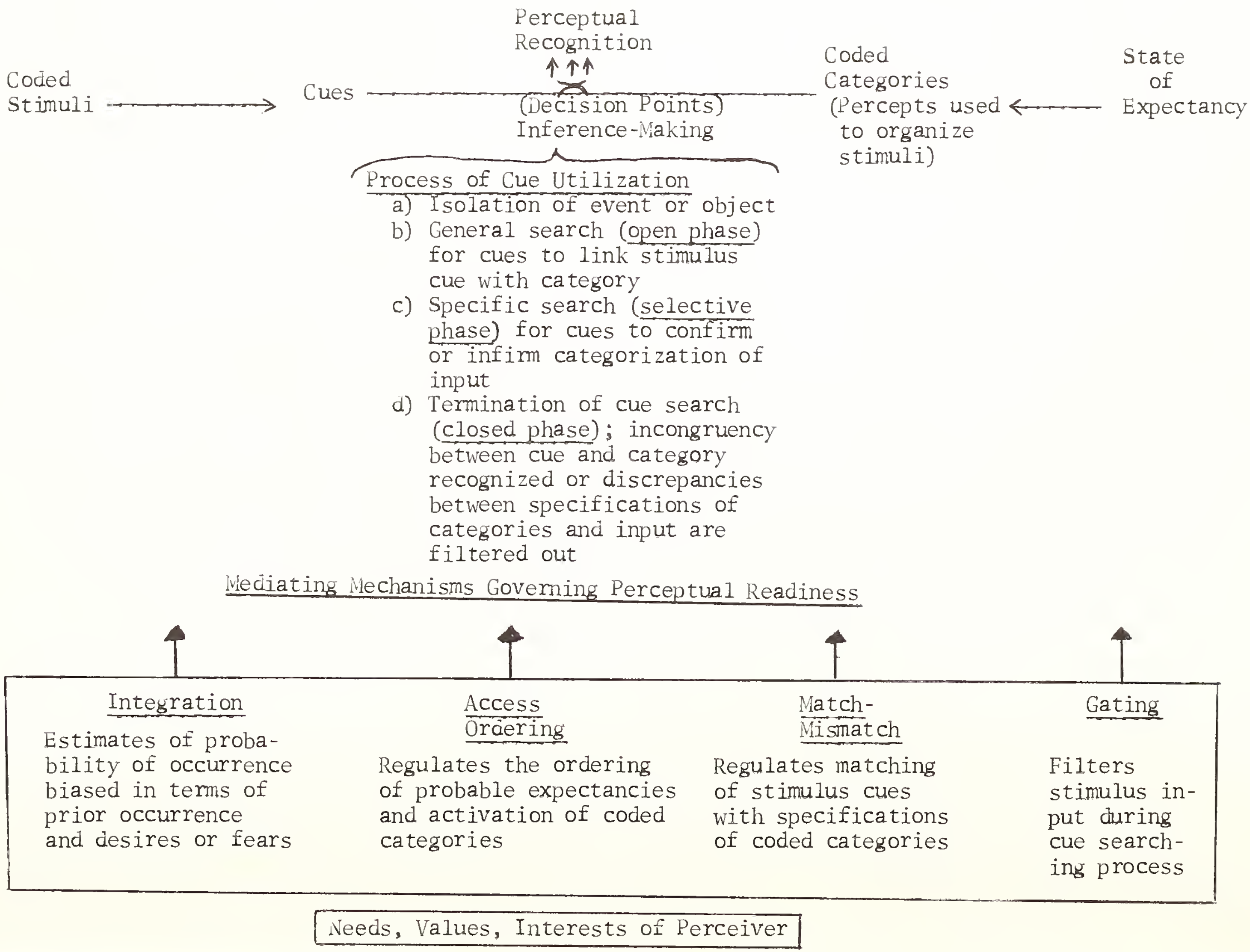


Fig. 2 - A Model of Perceptual Readiness

object was imprecise. Therefore, individuals were forced to look consciously for cues that would permit accurate identification of the incongruency.

Also identified in the model are four psychological mechanisms which serve as mediators of perception. Collectively, these mechanisms regulate estimates of probable occurrence or expectancy and the ordering of these estimates, and the processing of stimulus cues. By working in concert with the cue-utilizing strategy, these mediators help shape perceptual readiness.

Operationalizing the model in the form of a simulation gave rise to two important questions. Is there a general category of students (e.g., college students vs. high school students, or academically talented vs. "slow" students) for whom a simulation of this type might be ideally appropriate? Is there a specific form of media which would be more appropriate than another to examine the perceptions of a selected category of students? "Slow learners," operationally defined as those students who score in the bottom 1/3 percentile on a standardized aptitude test, in social studies classes in secondary schools were selected as subjects, on the assumption that they have more difficulty recognizing incongruity than more able students. Cartoons were selected as the basic medium to present problem situations with incongruities, since they possess desirable motivational qualities and would permit observation of appropriate behavior. Outlined and described below is the general structure of the simulation.

The Simulation

Basically, the simulation is self-pacing and includes the following components.

Cartoon Packet	The packet contains eight cartoons (dry mounted on posterbaord), each portraying a social situation (e.g., a person getting high on drugs, or a land developer destroying trees and creating a massive erosion problem). However, each cartoon contains an incongruency, e.g., an individual injecting a hypodermic needle in his arm with the following caption overhead: "No escaping the real world for me! I like it just fine!"
Xpect Deck and Title Card	For each cartoon there is a set of six cards. The first is a title card (e.g., in the first cartoon an appropriate title would be "No Copout"); two of the five remaining cards contain a statement that describes what an individual would expect logically to see in the cartoon. For example, given the above title, an appropriate Xpect card

might contain the following: A teenager who "thinks things out" and turns down drugs. One of the two cards describes something exactly the opposite of the scene in the cartoon, as in the above example. The other three cards contain nonsense statements.

PR Cards — Enclosed in an envelope adjacent to each cartoon are 5 "Perceptual Response" cards. One of the cards describes accurately the incongruency in the cartoon (e.g., the correct PR card for cartoon #1 reads: The guy in the cartoon is freakin' out, although he doesn't think so); The remaining four may or may not be related to the cartoon. If the participant can identify the incongruency before looking at any PR cards, he detaches a wooden match fastened to the posterboard and places it in the corresponding slot in the Response Box (described below).

Cue Questions — The structure of these questions follows the cue-utilization strategy presented in the model. Presented on the back of each cartoon, these questions force the participants to examine the cartoon more closely, i.e., look consciously for cues which will help them recognize the incongruency. These questions function as a sub-routine component of the simulation.

Response Box — Data are collected by means of a cardboard box. The box is approximately 14" x 16" and contains eight slots in the lid numbered to correspond with the cartoon exercise. A ninth slot is entitled "Discard" and serves such a purpose. The inside of the box is subdivided by cardboard sections so that each slot in the lid corresponds to a sub-section of the box. At the right side of the box is an envelope containing plastic objects used by the participant when responding to cue questions described above.

A flowchart of the simulation appears at the end of the paper. Once the conceptual leap from the model to the flowchart was accomplished, specific questions, in the form of hypotheses, were raised about the application of the model. For example:

Is there a positive relationship between a commonality of expectancies (selecting one or both of the Xpect cards logically consistent with the title card) and the frequency of correct perceptual responses (selecting the PR card that describes the incongruency)?

Do participants who identify the cartoon as puzzling (i.e., drop the match in the appropriate slot in the box) make correct perceptual responses more frequently than those who do not?

Do participants who enter the sub-routine function (i.e., respond to the cue questions) toward the end of the simulation make correct perceptual responses more frequently than when they entered the subroutine at the beginning?

Is there a positive relationship between a favorable disposition toward the simulation and performance, i.e., making correct perceptual responses?

While other empirical questions (e.g., I.Q., and performance in the simulation) about the basic model and the simulation might be raised, the preceding were among the chief questions of concern to the author. Presented below are the field testing procedures and initial field test results.

Field Test Procedure and Initial Results

Schools in three Florida counties--Leon, Escambia, Dade--were selected as field test sites. "Slow learners," as previously defined, enrolled in social studies classes during the 1973 summer school session in three schools in the above counties were selected as participants. Grade level of participants ranged from 9th through 12th grades. Before formal field tests were conducted in Escambia (Pensacola--Woodham High School) and Dade (North Miami Beach--North Miami Beach High School) Counties, a preliminary tryout of materials was held in Leon County (Tallahassee--Rickards High School) during June 1973. At that time the reactions to students, who were predominantly Black, to the content of the cartoons and the vocabulary in the captions led to general changes in the cartoons. Instead of ten cartoon exercises, as decided earlier, only eight were necessary, since approximately 35 minutes was still required to complete the 8 rounds. Initially five sets of materials were developed with the expectation that the simulation would be administered in groups of five students with one judge. The preliminary tryout of the entire package of materials at Rickards revealed, however, that a 1-5 ratio was inadequate. Each student required more careful guidance by the judge at the beginning of play than could be provided in the larger group; a 1-2 ratio seemed more appropriate. At the end of each play data were recorded on an observation sheet.

During mid-July, 1973, Woodham High School served as the second field testing site. Eighteen students (4 Blacks and 14 whites) enrolled in social studies classes for grades 9-12 served as participants. One judge per two students proved to be more effective than the larger ratio of 1-5, since each judge could assist the student more easily at the appropriate time. Following this series of field tests, changes were made in some of the Xpect and PR cards, since several participants were obviously hung up on three or four of the exercises. Changes were made also in the directions to improve the flow of play. The judge was asked also to emphasize that careful reading of the cue questions would improve the participant's chances of making a correct perceptual response the second time. These changes, collectively, were considered necessary to improve the overall operation of the next series of field tests.

The third series of field tests were conducted late in August, 1973, at North Miami Beach High School (Dade County). Fourteen "slow learners" from social studies classes were used as participants. Slightly over half were Black and Cuban-Americans, while all participants were in grades 9-12. As in Escambia County, the simulation was administered on a 1-2 ratio--one judge per two participants. At the end of each play, as in previous field test situations, as the data were recorded on an observation sheet.

Because the last series of field tests were held so close to the completion of this paper, none of the data have been treated thoroughly in a statistical fashion. The following observations have been made, and appear to be warranted somewhat by a crude examination of the data from the field tests in Dade County.

1. Most of the participants tended to select at least one of the two Xpect cards logically related to the cartoon title. When this was the case, participants tended to be more likely to identify the incongruency than if none of the selected Xpect cards were logically related to the title card. Consequently, there may be evidence to show that individuals who maintain a given expectancy are more likely than not to perceive a related incongruency. A more careful analysis of the data is required.

2. There does not appear to be much consistency between those who initially perceive the cartoon as puzzling (dropping the match in the appropriate slot) and correct perceptual response. The inconsistency in the data may be the result of a malfunction of a component in the simulation. While particpants were reminded frequently during play to "drop the match" if they saw the cartoon as puzzling, some of them may have ignored the directions. A modification in the media or rules should correct any malfunction.

3. On the surface, participants who enter the subroutine do not necessarily make more frequent correct perceptual responses toward the beginning of the simulation than toward the end. Consequently, experience with additional cartoon exercises may

or may not improve the participant's perception of incongruity. However, the last few cartoons are more complex and incongruency is more subtle; therefore, the benefits attributed to experience with more cartoon exercises may be negated, in part, by the increased difficulty level of the cartoon.

4. In general, participants did express a favorable disposition, as revealed through an opinionnaire, toward the simulation. Scores on the questionnaire by participants at Woodham revealed an extremely favorable disposition toward the simulation. Although the evidence is somewhat shallow, there does appear, at least on the surface, to be a positive relationship between performance in the simulation and player disposition.

In general, a more careful examination and statistical treatment of the data and additional field testing are necessary before more definite conclusions can be reached. Presented in this paper, however, is a general model of perception whose applicability and credibility should be more thoroughly tested. But if this brief paper has stirred someone's curiosity and imagination, then, perhaps, at least one purpose has been accomplished.

A paper presented in the panel "New Findings from Evaluative Studies," 12th Annual Symposium of the National Gaming Council and 4th Annual Conference of the International Simulation and Gaming Association, September 17-19, 1973. Sponsored by the U. S. Environmental Protection Agency and Rutgers University.

1. John Dewey, How We Think (Boston: D. C. Health and Company, 1933), pp. 12-14.

2. John Dewey, Logic: The Theory of Inquiry (New York: Henry Holt and Company, 1938), pp.107-9.

3. Jerome Bruner, "Personality Dynamics and the Process of Perceiving," in Perception: An Approach to Personality, ed. by Robert Blake and Glenn Ramsey (New York: The Ronald Press Company, 1951, pp.122-143.

4. A tachistoscope is a device with which visual material can be presented to subjects for durations as short as one one-hundredth of a second.

5. Jerome Bruner and Leo Postman, "On the Perception of Incongruity: A Paradign," in Perception and Personality: A Symposium, ed. by Jerome Bruner and David Krech (Durham: Duke University Press, 1949), pp. 213-21.

6. Jerome Bruner, "On Perceptual Readiness," Psychological Review, LXIV (1957), 123-141.

7. Ibid., 131.

ADDENDUM I

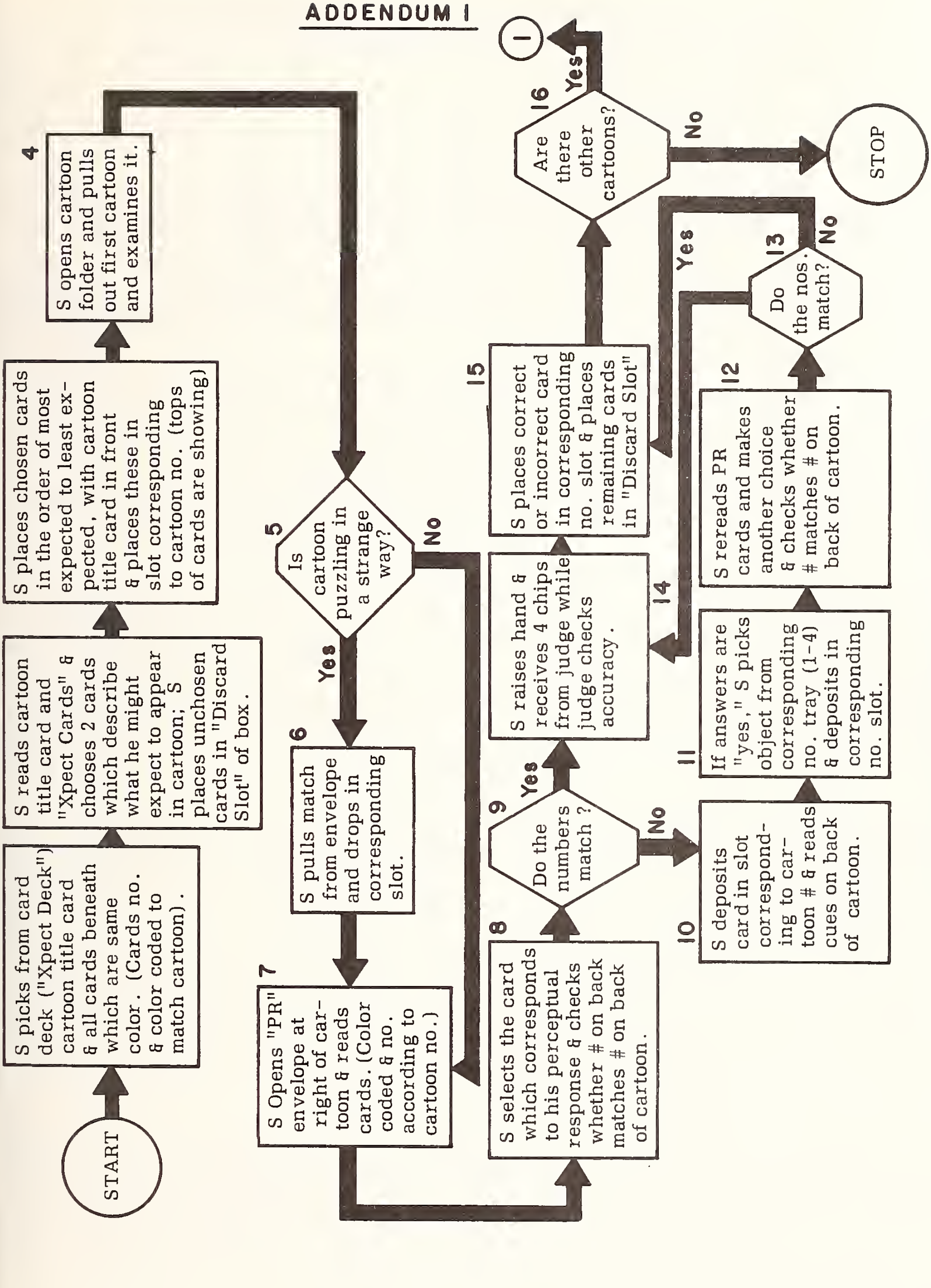


FIG.3--DATA COLLECTION FLOWCHART
AFTER TENTATIVE MEDIA SELECTION

The What and Why of Gaming
A Taxonomy of Experiential Learning Systems

By Brent D. Ruben
Institute for Communication Studies
Rutgers University
New Brunswick, N. J. 08903

It is difficult -- perhaps impossible -- to contribute much significance to the theory or philosophy of instructional games and simulations, without considering both in terms of the more generic concept of experiential or experience-based learning. From such a perspective, simulations and games, along with structured group exercises, role playing activities and encounter groups, are all instances of purposeful, structured, information-processing environments where learning is an intended outcome.

The conceptual roots of contemporary thought regarding experiential learning date to the works of John Dewey 1/ and Maria Montessori 2/ both of whom emphasized the role of experience and communication in classroom learning environments nearly three quarters of a century ago. However, the current interest in experience-based learning would seem to be much less a direct consequence of those early developments, and more a reflection of complementary influences in various spheres of activity in more recent times.

One such thrust has come from the business and industrial community where in the past several decades an increased emphasis has been placed upon organizational development, human relations, internal communication, and employee and management in-service training, in general. In searching for training techniques which seemed theoretically sound and operationally compelling, games, simulations, role playing activities and encounter sessions of various intensities proved attractive.

Social psychologists, sociologists and individuals in the fields of communication and management provided another influence as a consequence of their study of group dynamics, leadership and group decision-making. Experiential learning, and in particular the encounter group design, found growing acceptance also with psychiatrists, social workers, counselors, religious leaders and tohers who applied the techniques in therapeutic training contexts.

An additional source of influence came from work in the area of games and simulations. As Tansey and Unwin 3/ note, the use of simulation and games has a lengthy heritage, dating perhaps to the development of chess as a symbolic tactical encounter between opposing factions. War games of various sorts were also used widely in World War II, particularly by the Japanese and Germans and later by the United States and Soviet Union. 4/

Perhaps the single greatest thrust has come as a result of a broadly-based questioning of traditional educational values, systems of instruction and approaches to learning. The scholarly contributions of Bruner5/ and Rogers6/ have been particularly impactful in this regard, along with the more popular works of such individuals as Postman and Weingartner, 7/ Riesman, 8/ Goodman 9/ and Holt 10/ to mention only a few. The following passage from the student-authored Champaign Report provides a succinct statement of some of the concerns which have since been voiced by many:

The artificial gulf between ideas and action must be bridged so that learners learn ideas for action.

Faculty members ought to try taking a student to lunch sometime.

Smallness or largeness have no inherent value in an institution, but continued opportunity for contact with diverse primary groups must be offered to all students.

Efficiency has been overrated as an educational device, and chaos has been underrated.

We must develop devices for continued examination of what is significant and what is insignificant learning.

Base learning on problem solving. Get a bunch of freshmen together and tell them: We have a problem and we want you to work on it for the next four years. How do you feed the world? At the end of that time, you'll have sociologists and botanists and engineers and political scientists, and God knows what, but they will have learned because they had an important question to answer and because they thought their particular discipline might shed some light on it. 11/

In response to these and other suggestions, experience-based learning has been perceived as one potent means of rejuvenating and re-styling the standard class room learning environment.

Nourished by these and other influences, experiential learning has continued to grow in popularity and acceptance. And, as has been noted often in the literature, experience-based learning, at face value at least, has numerous advantages over alternative instructional methods. For one thing, simulations and games are generally constructed with a problem focus and participants frequently seem well motivated as a consequence. Experience-based learning, it has been said, fosters questioning, inquiry and structural learning in addition to teaching specific content. Another frequently mentioned virtue of experiential settings is the capability for minimizing space and time constraints often present in alternative training contexts. Students need not wait days, months, or years to gain a sense of the consequences of their decisions and actions. Experience-based environments also seem to be particularly useful for helping students come to understand and learn to cope directly with change and ambiguity. And, of course, in laboratory environments risks, responsibilities and severity of outcomes can be controlled to make it possible for participants to "fail" without full consequence.

A TAXONOMY

In spite of the widespread application of the specific techniques of gaming, simulation, role playing and encounter groups, relatively little attention has been directed toward considering the more generic category, experience-based learning. The remainder of this paper is directed toward this goal. 12/ Presented is a classification scheme for categorizing experiential learning systems in terms of the structure of the activity and the instructional objectives of the facilitator. As the substance of this paper argues, these dimensions are critical both to the conception and operationalization of any experience-based learning environment.

The Structure of Experience-Based Learning Environments

Experiential techniques come in any number of different packages and with a variety of purposes. All experience-based instructional activities can be thought of as contrived human communication systems, and as such, all share in common a number of structural elements which are crucial to their operation. The five elements are:

1. roles
2. interactions
3. rules
4. goals
5. criteria

Structurally, simulations and games and other experiential designs involve: 1) participants case in roles, 2) interactions between those roles, 3) rules governing those interactions 4) goals with respect to which the interactions occur, and 5) criteria for determining the attainment of the goal and the termination of the activity.

Role

Experiential environments require participants. Except for those unique situations in which one participant "plays" against himself, there are always two or more individuals involved. The term role refers here to the identities individuals assume while taking part in a simulation, game, or encounter group.

In a number of games and role playing exercises, rather definitive and elaborate role descriptions are provided by the designer. In SENSITIVITY, 13/ for example, a portfolio containing a fictionalized biographical sketch is distributed to each player. Participants are asked to assume the role of the character described in the folio as best they can. The structural element of role is particularly crucial to this game, and all player activities revolve around their actions and reactions to one another in their assumed roles.

The players, taken all together then become a group of very troubled people, who meet to gain some help and insights from each other. Each tries to make his character understandable to the group, communicating as much about himself and his problems as he can. 14/

SIMSOC 15/ is an example of a more complex social simulation in which roles, specified in great detail, are extremely important to the functioning of the activity from both an operational and instructional standpoint. SIMSOC participants serve in roles in one of seven basic groups. Two of the groups are industrial units, and two are political parties. The other three are: an employee interest group, a mass media group and a judicial council. Additionally, a specified proportion of participants in the simulated society must be affiliated with one of the two political units and with the group of independents.

Members of the Party of the People (POP) are told that they are to emphasize individual autonomy and decentralized decision-making. "They are not rigid about such opposition, and are willing to accept planning and centralized coordination if it appears absolutely necessary." 16/

Members of the Society Party (SOP) are encouraged to emphasize central planning. "Its members believe that it is necessary for individuals and groups to yield some of their autonomy in order that effective leadership be provided and anarchy avoided." 17/ Independents are told they have no strong opinions one way or another about these issues.

Both SENSITIVITY AND SIMSOC are examples of experience-based instructional systems in which roles are prescribed rather specifically and have a crucial and generally predictable impact on the overall operation of the activity.

The encounter group, in idealized form, represents an experience-based environment, which differs dramatically with respect to the origin of the role definitions players assume. 18/ Roles -- the way participants are to act -- within such a group are not specified on an a priori basis, nor are they prescribed by the designer. The same is true, although to a lesser extent with two-team variations of PRISONERS DILEMMA 19/ and some versions of WIN AS MUCH AS YOU CAN. 20/ In each context, the nature of participant roles emerge primarily as a product of whatplayers bring with them to the activity, and as a consequence of the interpersonal transactions that occur as the activity progresses.

STAR POWER 21/ and THEY SHOOT MARBLES DON'T THEY 22/ provide examples of structured environments which fall somewhere between the two extremes, with regard to role delineation, tending perhaps toward the less specified, less structured end of the continuum.

Interactions

The operation of all games and simulations depend upon the interrelating of participants. The manner in which these relationships originate and develop may vary from one game or simulation to the next as does the method, procedures and channels available for transactions between players.

MONOPOLY, [23] for example, utilizes a large number of devices to foster interactions between players including tokens, play money, "houses," "hotels," property deed cards, community chest and chance cards.

The availability and necessity of using multiple channels of communication is crucial to the functioning of MONOPOLY and to many instructional games and simulations.

In other games and simulations interaction channels and means for their utilizations may be less prescribed and specified. This is, for example, the case with most role playing exercises, where a wide range of verbal and nonverbal interactions are available to players as a part of the activity. The range and diversity of transactions between player roles are limited more by the range of a participant's ingenuity than by the design of the game or exercise.

HANG-UP[24] is an example of a game which utilizes diverse channels of interaction. The game is designed to focus upon and increase participant sensitivity to the subtleties of racial differences. Participants react to a series of hypothetical "crisis situations," described on cards, as they think typical whites or blacks would. In turn, participants charade their reactions to the various crisis situations while others involved in the game try to guess the player's "hang-up", and whether he is playing the role of a white or black.

INTERACT, [25] and its immediate predecessor INTERMEDIA, [26] provide an instance of simulation environment which utilizes emergent and diverging interaction channels. Both simulations involve a laboratory society, the basic industries of which are communication and mass communication enterprises. Participants serve as Individual Agents, members of Mass Communication Organizations, Communication AGencies or an Executive Council. In addition, all participants serve as Consumers for communication products developed by the various Communication Organizations.

Together, Individual AGents and managers of the Communication Organizations negotiate, prepare and present their resulting communication products to the Consumers, according to a predetermined timetable. The Consumers are exposed to and in turn evaluate the products of each Communication Organization relative to one another and award income or subsistence points based upon their assessments. The points each Communication Organization accumulates are distributed among the members of its staff in whatever manner the organization selects.

In addition to this basic interaction pattern, a wide range of alternatives are possible. Essentially, any individual or group of individuals can provide any communication product or service to any group within the society so long as they are able to accumulate enough income points for their efforts to survive in the economy of the simulated society.

Rules

The interactions between participant roles in experiential contexts are governed by a series of rules or guidelines. Rules are typically specified by the designer and presented to the player as "instructions" for play. The number and specificity of rules governing the interactions vary greatly from one experiential activity to another. Rules may enumerate actions which are permitted of players, or they may list only those activities which are precluded, leaving open the possibility for all other actions.

This distinction is an important one. Those rules which specify and enumerate actions and behaviors which are permitted and necessary for participants can be termed prescriptive. Those rules which prohibit certain participant actions leaving all other possible behaviors open are proscriptive.

In some instances, the designer utilizes the rules and behavioral guidelines players bring to the situation as a primary source of rules for the game or simulation exercise. The encounter group may be an extreme form of this variety of rule generation. Particularly where one conceives of an encounter group as a simulation of the communication processes involved in social organizing, rules are generated from the participants' assumptions as to how the encounter group should progress, what activities and behaviors ought to be allowed and which should be excluded. At a minimum, several meta-rules must be imposed by the encounter designer or trainer. Individuals must, for example, agree to participate in the formation of the group and to react to subsequent activities occurring as the group develops. Additionally, a common rule limits content of discussions to issues of present relevance to members of the group, while excluding discussion of "back home" situations. This "rule" is often referred to as a "here and now" norm. As a group develops around even this minimal set of conditions, many more rules evolve, some of which are explicit -- many others implicit. This process develops in much the same fashion in the encounter group as it does in a society or in any other social enterprise.

In other sorts of experience-based instructional exercises, traditional and direct means for interactions between participants are intentionally excluded by the rules in order to focus on particular issues. This is the case with the widely used COOPERATION SQUARES exercise, which has the following rules:

1. No member may speak
2. No member may ask for a card or in any way signal that he wants one
3. Members may give cards to others 27/

Participants in this exercise are divided into five-person groups. Each group member receives an envelope containing several puzzle cards. When assembled, the puzzle cards possessed by the members of the group form five equal squares. No one member of the team has all the cards necessary to complete a puzzle-square. Only through exchanging pieces with other participants can the task of assembling five squares of equal size be completed.

The exercise and the discussion which follows is intended to focus upon the issues involved in communication and effective cooperation, and to help participants become more aware of how particular behaviors may help or hinder group problem solving.

Goals

While goals are crucial to the design and implementation of experience-based activities in general, the extent to which they are overtly presented to participants varies greatly from one simulation or game to the next.

In the cooperation squares exercise discussed previously, the activity goal is stated rather directly:

> Each person should have an envelope containing pieces for forming squares. At the signal, the task of the group is to form five squares of equal size. The task is not complete until everyone has before him a perfect square and all the squares are the same size. 28/

Often the goal of an exercise, game or simulation is given in the instructions, stated as "the objectives" of the game. Where two or more individuals are involved, the goal often takes the form of a statement of what one must do "to win."

In contradistinction, the goals of an encounter group or to a lesser extent of simulations such as THEY SHOOT MARBLES DON'T THEY, INTERACT, or INTERMEDIA, depend primarily upon the decisions participants make and often emerge at a point well into the development of the activity. In such situations, the goals may never be articulated in the group as a whole, and it is not necessary for each individual's goal(s) to be identical with the goals of others.

Somewhere between these two extremes are games and simulations with multiple goals, prescribed by the designer. SIMSOC is an example. As indicated earlier, all SIMSOC participants serve in one of two political parties -- or as an independent. The Participant's Manual reads:

> If you are assigned to one of the two political parties, you are to consider the achievement of the party's program one of your own personal goals and to work for this when it appears appropriate to do so. 29/

In addition to participation in one of seven basic groups with attendant goals, and political affiliation with additional goals, each participant must also select one of three personal goals -- power,, wealth or popularity -- to emphasize in playing the game.

A participant adopting a power goal tries to influence what happens in the society as much as possible. Those electing to seek wealth try to accumulate as much of the currency of the society as possible by the end of the game. The third alternative is to emphasize popularity and strive to become as well liked by other stimulation participants as possible.

Criteria

Experiential activities must have a means of ending. A determination is made that the goals have been reached using certain criteria and this signals the end of activity. Some games and simulations rely heavily upon the use of fixed and prescribed criteria for determining when goals have been met and activity is to terminate. Others make use of the ambiguity that results when criteria for determining the achievement of goals are unclear, changing and highly personal. The criteria can be prescribed by the designer in advance or may emerge from the decisions of players.

In games where the goal is rather directly stated, often in terms of winning, the criterion is typically an announcement by a participating individual that in his assessment he has fulfilled the goal. "Bingo" is an example. A pronouncement of this sort is also used with the COOPERATION SQUARES exercise discussed previously.

In many cases the criterion for determining when the goal has been reached depends upon time constraints. This is the case in an encounter group or INTERACT where the length of time available is a primary factor in determining the termination of activity. Others, such as STARPOWER are terminated at the discretion of the facilitator with or without input from participants.

Internal and External Parameters

While all experience-based learning systems involve considerations relative to roles, interactions, rules, goals and criteria, not all experience-based environments apply these design parameters in the same manner.

Experience-based learning environments can be designed and utilized such that control of parameters is centralized in the hands of the designer as is the case with many canned or pre-programmed games and exercises, or control can be diffused among participants.

The dimension of control, so essential to an understanding of the instructional system, is also important to the appropriate design and utilization of instructional simulations and games. It would seem to be largely the deployment of parameter control which operationally distinguishes the more content-centered and predictable games and simulations from those which would seem to foster more generic an individualized learning. In those experiential activities where primary control of the parameters rests with the designer or instructor, the game or simulation can be said to be externally parametered. Where the control for establishing and modifying role, interaction, rule, goal and criterion parameters resides primarily with the participants, the activity is internally parametered.

Examples of external parameter games and simulations include the many structured, often computer-assisted, social and management simulations, games and related exercises where the participant strives to learn the designer's theory of a particular phenomenon. The participant in external parameter experiential environments, typically tries various strategies and procedures in an effort to arrive at a particular winning combination which has been predetermined by the designer or instructor.

External parameter simulations are frequently relatively simple, low ambiguity situations, with specified and prescribed role descriptions. The "right" and "wrong" strategies for behaving and interacting are fixed, or are varied in predictable ways known and controlled by the designer or educator. The criteria for winning are externally imposed.

Both the problems with which a participant deals, and the solutions to those problems have been determined on an a priori basis by the designer and have little or nothing to do with the actions and reactions of the participants. The correct strategies are essentially the same from one iteration of the game or simulation to the next.

While games and simulations which are externally parametered are numerous, there are few internal parameter games and simulations in existence. In idealized form, the encounter group represents one of the clearest examples. What it is that is to be learned, and the ways the learning is to occur are not specified or pre-determined by a designer, instructor or trainer, but rather depend almost totally upon what the participants decide to do and the ways in which they reach those decisions. Variation is tolerated and encouraged in internal parameter simulations. Problems are defined through participant thoughts and actions and are solved in a similar sense, rather than being imposed by the design of the game. In games and simulations where parameters are internal the activity of the participants generates and modifies the roles, interactions, rules, goals and criteria.

Figure 1 presents some major differences between the external and internal parameter experiential designs. (See page 68)

Figure 1
Structural Elements and Design Characteristics
of Experience-Based Systems

	Externally Parametered	Internally Parametered
Roles	assigned	emergent
	rigid	flexible
	low ambiguity	high ambiguity
	simple	complex
Interactions	channels specified	channels emerge
	patterns prescribed	patterns emerge
	low ambiguity	high ambiguity
	few channels available	multiple channels available
	predictable	unpredictable
Rules	prescriptive	proscriptive
	fixed	flexible
	constant	changing
	low ambiguity	high ambiguity
	specified	emergent
Goals	imposed	emergent
	uniform	individual
	single	multiple
	clearly defined	ambiguously defined
Criteria	predictable	unpredictable
	uniform	individual
	single	multiple
	likely to involve "winning"	unlikely to involve "winning"
	clearly defined	ambiguously defined

Clearly, no game or simulation is at the extreme position of being entirely parametered externally nor of being totally internally parametered. It must be noted that to some extent, all learning environments are participant controlled, whether that control is delegated explicitly be design or not. What is learned and the way that learning occurs always depends ultimately upon the learner. The game designer or user provides the necessary but not sufficient conditions for learning.

Notwithstanding this important point, the instructor or facilitator must continually make decisions as to the design and utilization of instructional methods -- including games, simulations and similar experience-based activities. Curricular decisions are made upon the basis of learning goals, and it would seem reasonable that decisions to design or utilize particular kinds of experiential systems be made on a similar basis.

The relative appropriateness of internal versus external parameters likewise would seem to depend upon the particular learning goals involved. External parameter simulations seem generally better suited for teaching specific content, while internal parameter games and simulations appear more appropriate for the learning of problem-solving processes.

Where the learning goals suggest that what is to be learned is specific, prescribable, predictable, and determinant, external parameter environments are appropriate in that the designer or implementing instructor wants all students to learn the target facts, strategies and procedures in the same way. The structural elements of the game or simulation will therefore need to be controlled and manipulated intentionally, to insure that participants deal with specific issues, using specific interactional channels, according to prescribed rules, in order to achieve the designer's predetermined goals.

Take for example a role playing exercise designed to help students learn the content of a particular historical decision, experientially. The structural elements of the exercise would need to be controlled such that participants were unlikely to introduce "creativity" into the exercise, which might lead them to arrive at a decision quite unlike that which actually took place.

External parameter activities are generally appropriate when the learning desired is in the form of answers or decision which are fixed, constant over time and tend to be technical in nature.

Internal parameters, on the other hand, are generally better suited than external parameters in instances where the learning is to be structural, general, not prescribable, unpredictable and indeterminant.

Experience-based activities designed to help students learn about the processes of decision-making, might utilize historical role playing exercises similar to that discussed previously. In this case, however, that which is to be learned is a process and learning specific content of decisions would be dysfunctional. Given this kind of learning goal, creativity is highly desirable, and it is not necessary -- nor desirable -- for all participants to learn the same things about decision-making in the same way from the exercise. Neither is it necessary for all of the individuals who participate to come to the same conclusions as to what were the "right" and "wrong" decisions.

Internal parameters seem generally more appropriate for teaching such things as communication, questioning, inquiry, leadership, decision-making, and social and organizational competence. These sorts of competencies and knowledges are situational, and the judgment of "rightness" or "wrongness," of an individual's style of attacking a problem, or coping with other people, is highly subjective and must always be evaluated relative to the context.

There are several additional criteria which are useful for distinguishing between circumstances appropriate to the use of external and internal parametered games and simulations. These depend upon the learning system meta-goals. Where the attempt within an instructional system is toward fostering homogeneity, uniformity and interchangeability among students external parameters are in order. Internal parameters are more appropriate where the meta-goal is to provide an environment which encourages heterogeneity, diversity, and individual uniqueness. Externally parametered simulations and games are therefore suggested where it is desirable for all participants to learn more or less the same things in more or less the same way -- as with specific content. If it is desirable for all participants to learn different things in diverse ways -- as with processes of problem-solving then an internal parameter design is probably better suited for the purposes.

Concluding Remarks

Hopefully, the preceding framework has some direct utility for classifying experience-based learning systems along the dimensions of structural composition and parameter control. By indirection, the scheme may also serve several subtle, heuristic functions:

1) It suggests that in addition to games and simulations, a wide range of techniques which at first glance appear unrelated, can be meaningfully subsumed within the category of experience-based learning.

2) It implies the potential relevance of theory and research from these diverse areas for understanding the scope, functions and outcomes of games and simulations.

3) It indicates the necessity of designing, utilizing and evaluating experiential techniques in a manner consistent with thoughtfully articulated instructional objectives.

4) It implies that the instructor or facilitator's posture within an experient learning environment can be crucial to the nature and outcome of the total experience.

In my opinion, these four issues and the myriad of questions that they suggest, circumscribe a critical area of concern upon which comprehensive gaming theories of the future must ultimately focus.

1 Readers interested in pursuing these notions in depth may wish to examine John Dewey: Lectures in the Philosophy of Education, 1899 by Reginald D. Archambault (New York: Random House, 1966), especially Lectures VI and VII, pp. 59-75.

On pages 65-66 of that volume Dewey says: "There seems a very practical existing tendency in the direction of the recognition of this principle, that fundamentally speaking, the educative process must be the same within and without the school walls....When we say the materials and methods are the same it is not that all distinction must be wiped out or overlooked, but it does mean that the school has for its function the organization in a more conscious and thorough going way the resources and the methods and materials that are used in the more unconscious and haphazard way outside."

See also John Dewey, Experience and Education (New York: Macmillan, 1938) and Democracy and Education (New York: The Free Press, 1916).

2 Readers interested in writings of Maria Montessori may wish to examine The Montessori Method (New York: Schocken Books, 1964) and Spontaneous Activity in Education (New York: Schocken Books, 1965).

3 P. J. Tansey and Derick Unwin, Simulations and Gaming in Education (London: Metheun Education, Ltd., 1969), p. 1.

4 John R. Raser, Simulation and Society: An Exploration of Scientific Gaming (Boston: Allyn and Bacon, 1969), p. 1.

5 See especially The Relevance of Education J. S. Bruner (New York: W. W. Norton & Co., 1971); Learning About Learning: A Conference Report, J. S. Bruner (ed.) (Washington: U. S. Government Printing Office, 1966); J. S. Bruner, The Process of Education (Cambridge, Mass.: Harvard Press, 1961); J. S. Bruner, Toward a Theory of Instruction (New York: Norton, 1966); and J. S. Bruner, Rose R. R. Oliver and Patricia M. Greenfield, et. al., Studies in Cognitive Growth (New York: John Wiley & Sons, 1966).

6 See especially Encounter Groups, Carl Rogers (New York: Harper and Row, 1970); "The Characteristics of a Helping Relationship," excerpted from On Becoming a Person by Carl Rogers (Boston: Houghton Mifflin, 1961), Chapter 3, pp. 39-58; Carl Rogers, Freedom to Learn (Columbus, Ohio: Charles E. Merrill Publishing Co., 1969); Carl Rogers, "Interpersonal Relationships: U.S.A. 2000." This paper was part of a symposium sponsored by the Esalen Institute, San Francisco, entitled "USA 2000" on January 10, 1968. See also Carl R. Rogers, "The Process of the Basic Encounter Group," in Challenges of Humanistic Psychology, James F. T. Bugental (ed.) (New York: McGraw-Hill, 1967).

7 Neil Postman and Charles Weingartner, Teaching as a Subversive Activity (New York: Delacorte Press, 1969), pp. xiii-xiv.

8 Especially Constraint and Variety in American Education, David Riesman, (Lincoln, Nebr.: University of Nebraska Press, 1968).

9 Especially Compulsory Mis-education, Paul Goodman (New York: Vintage Books, Random House, 1962).

10 Especially How Children Learn, John Holt, (New York: Pitman Publishing Co., 1967).

11 Champaign Report: A Conference on Educational Reform, A Student View, Paul Danish (ed.), (Champaign, Ill.: September, 1966), pp. 6-7.

12 A more extensive development of the ideas presented in this paper, with particular attention to the design and implementation of internal parameter simulations is provided in "The General Problem Solving Simulation," Brent D. Ruben, in Experience Learning, Robert S. Lee, ed., (New York: Basic Books, in press).

13 The game Sensitivity was designed and developed by Jonah Kalb and David Viscott in 1969 and is distributed by Sensitivity Games, Inc. of Boston. Information included in this chapter on sensitivity is based upon the instructions furnished with the game.

14 "Instructions," the game of Sensitivity.

15 William A. Gamson, SIMSOC: Participant's Manual (New York: The Free Press, 1969) and SIMSOC: Instructor's Manual (New York: The Free Press).

16 Ibid., p. 13.

17 Ibid., p. 13.

18 A provocative discussion of the encounter group as an instructional simulation is provided by Richard W. Budd in a recent paper entitled "Communication, Education and Simulation: Some Thoughts on the Learning Process," Institute for Communication Studies, Iowa City, Iowa, December, 1970.

19 One variation of PRISONERS' DILEMMA for use with groups is provided in Human Communication: Simulation and Games, Brent D. Ruben and Richard W. Budd, (New York: Hayden Books, in press).

20 WIN AS MUCH AS YOU CAN is described in A Handbook of Structured Experiences for Human Relations Training, J. William Pfeiffer and John E. Jones, (Iowa City, Iowa, 1970)

21 STARPOWER was developed by R. Garry Shirts and is distributed by Western Behavior Sciences Institute.

22 THEY SHOOT MARBLES DON'T THEY is available from Learning A. and M., Ann Arbor, Michigan.

23 The game of Monopoly is distributed by Parker Brothers, Inc.

24 The game of Hang-Up is distributed by the Unitarian Universalist Association of Boston, Mass.

Information included in this chapter about Hang-Up is based upon the instructions furnished with the game.

25 The INTERACT simulation is described in INTERACT, Brent D. Ruben, (Kennebunkport, Maine: Mercer House Press, 1973).

26 The INTERMEDIA simulation is described in INTERMEDIA, Brent D. Ruben, Albert D. Talbott, Lee M. Brown and Henry G. LaBrie III, (Iowa City, Iowa: University Associates Press, 1970). Descriptions of abbreviated versions of INTERMEDIA are <u>The Communication System Simulation</u>, Albert D. Talbott and Brent D. Ruben, (Iowa City, Iowa: University of Iowa School of Journalism, 1969), and in <u>Human Communication: Simulations and Games</u>, Brent D. Ruben and Richard W. Budd, (New York: Hayden Books, in press).

27 Dorothy J. Mial and Stanley Jacobson, <u>10 Interaction Exercises for the Classroom</u> (Washington: National Training Laboratory, Institute for Applied Behavioral Science.

Information included in this chapter is based upon the instruction sheet provided with "Experiment in Cooperation."

. This exercise is also discussed in <u>Human Communication: Simulations and Games</u>, Brent D. Ruben and Richard W. Budd, (New York: Hayden Books, in press), and in J. William Pfeiffer and John E. Jones, <u>A Handbook of Structured Experiences for Human Relations Training, Volume I</u> (Iowa City, Iowa: University Associates Press, 1969).

28 <u>Ibid</u>.

29 Gamson, <u>op. cit</u>., p. 13.

CONFLICT RESOLUTION: FROM POWER TO PEER RELATIONS IN THE HELPING PROFESSIONS

Patricia Yancey Martin and Marie Withers Osmond
The Florida State University, Tallahassee, Fla. 32306

Summary. The present paper develops the position that clients in search of needed social services are: (1) in a relatively powerless--dependent, subordinate--position vis-a-vis the professionals who provide these services; and (2) in conflict with the service-providers over the type, quantity, and quality of services which they will receive. Building on Blau's theory of social exchange and power, conditions which sustain (or, allow one to avoid) a power relationship are reviewed. With the aim of identifying means for decreasing the power of the professional over the client, experiments were conducted which utilized two basic versions of a "mixed-motive" (prototype) social simulation game. Results of play by 214 undergraduate students suggest that greater accountability of professionals to clients and to society--for their actions and the results of their actions--will diminish the power of the professional over the client and enhance the bargaining position of the client. Conclusions are in terms of additional means for changing professional-client associations from power to peer relations, to make professions more responsive to client wishes and needs. This study demonstrates the great utility of social simulation games as a research method for testing exchange theory, and encourages us toward construction of more precise games for use in future research.

The sociological literature on social and health service provision abounds with evidence that the individual person in need of services is, in essence, at the mercy of the service providers. From Goffman's (1962) asylums (where persons with emotional problems are taught to be mental patients) to Scott's (1969) agencies for the visually handicapped (where persons with sight problems are taught to be "blind men"), the situation is similar. Persons who find themselves in need of help or assistance from others often find themselves in a powerless position as a result of their needs. Their powerlessness stems from the fact that they approach a given professional with specific needs to be met, while the professional, who needs clients to be sure, comes to them as only some among many possible clients--any of whom would "fill the bill" equally as well. This results in the clients' greater dependence on the professional than vice versa, and leads to their occupancy of a subordinate position in relationship to the professional. As Blau (1964) has noted, the individual in a dyadic association who is less dependent has power over the one who is more dependent. Thus, we characterize the helper-helpee relationship in general--including social worker-client, physician-patient, and even teacher-student--as a power relationship. Associations on which both parties are equally dependent, or nearly so, are characterized as peer relations. As stated by Blau (1964:29), "while reciprocal services create an interdependence that balances power, unilateral dependence on services maintains an imbalance of power."

The present paper is based on Blau's theory of social exchange and power (1964). Central to this theory is the assumption that conflicting as well as common interests and goals are an integral aspect of associations in everyday life. In the professional-client relationship,[1] conflicts of interest are perhaps more numerous than common ones. Of course, both professional and client have a minimal common interest in effecting and maintaining an association: the professional, because he needs clients to maintain a practice, make money, and/or fulfill job or organizational quotas regarding caseloads, and so forth; the client, because he has need for assistance or services which he hopes the professional will provide. Beyond this minimum base, however, conflicts seem to predominate. The client desires the professional's full attention, best services, and most effective results--depending on the nature and extent of the needs with which he approaches the relationship. The professional, on the other hand, may already be over-burdened with clients, or may be more interested in making money or influencing associates than with meeting client-needs. And to some extent, from the professional's viewpoint, one client is as good (or bad) as another; it does not really matter who the clients are, so long as there are sufficient numbers--and proper kinds--of them available to meet whatever goals he has for himself in practicing his profession or trade.

In short, a client's interest in his relationship with a professional is more intrinsic than is the professional's interest in him. The client approaches the relationship with a personal need--and often, an urgent one--for counseling, for surgery, for rent money, dental care, or clothes for the

---

[1]The terms "professional" and "client" are used here and throughout this paper in the broadest general sense. They refer to service-provider and service-seeker (or recipient) in all manner of education, health, and social service arenas.

children. The professional's interest in the client, however, is more extrinsic than intrinsic; while he does need clients with proper problems, it is really immaterial to his practice exactly which clients come.

Given the conflicts of interest between professional and client, and given the client's greater dependence on the professional--which places him in a position of subordinance--what can be done to lessen the power of the professional and to increase that of the client, in the helping process? Short of drastic institutional change, we suggest that the most reasonable direction at present is to increase the professionals' dependence on the outcomes of his services to clients. The central theme of this paper is that movement toward greater accountability of the service provider--for his actions and the results of his actions--to service providee is the most feasible means of changing associations in the helping process from power to peer relations.

Exchange and Power in Social Life

"To speak of social life is to speak of the associations between people--their associating together in work and in play, in love and in war, to trade or to worship, to help or to hinder" (Blau, 1964:12). Basically, it is the forces of social attraction--whether intrinsic, extrinsic, or both--that bring persons into association with one another. Once in each others presence, the primary process via which social structure--or relationships--emerge is that of social exchange. Social exchange, as defined by Blau (1964:91), ". . . refers to voluntary actions of individuals that are motivated by the returns they are expected to bring and typically do in fact bring from others."

The major aspects of exchange theory on which the present study is based are as follows. (1) Unspecified obligations. The most significant distinction between economic exchange and social exchange is that the latter entails unspecified obligations, while the terms or products of economic exchange are generally specified or explicit. Social exchange involves the principle that when one person does another a service, though there is a general expectation of some future return, its exact nature is definitely not stipulated in advance. (2) Trust. A consequence of the unspecified nature of obligations inherent in social exchange is the necessity for trust in interpersonal transactions. Blau notes, "Since there is no way to assure an appropriate return for a favor, social exchange requires trusting others to discharge their obligations" (1964:94). (3) Symmetry. The symmetry of a social relationship is defined as the extent to which the two parties are equally committed to it. If they are not so committed, the party with the least commitment has an advantage over the other, and the relationship may be characterized as one involving power. If the parties are equally--or reciprocally--committed, the relationship is known as a peer relation. In a power relationship, the partner who is least committed may utilize the advantage he has thereby, to exploit or otherwise take advantage of the more committed member. It is of central concern here to identify those features of institutionalized professional-client relations which can be altered to attenuate the chances of exploitation of the client.

(4) Attraction. The "attraction" dimension of social transactions refers essentially to the reason(s) of the parties for entering and/or remaining in the relationship. These can vary along a dimension from purely intrinsic to purely extrinsic. Most associations have elements of both types of attraction in them, though one type or the other may predominate. While the professional-client relationship is essentially extrinsic in character, we noted earlier that the client's reasons for participation generally have more of an intrinsic aspect to them than does the professional's.
(5) Functions. There are two general functions of the social exchange process. One is to establish bonds of friendship (or peer relations) and the other, to establish superordination over others (or power relations). Since the major goal here is to explore measures by which professional-client relations can be transformed from power to peer relations, a review of the basic conditions which sustain a power relationship is in order.

Power Relations: Their Formation and Persistence

Power is defined here as ". . . the ability of persons or groups to impose their will on others despite resistance" (Blau, 1964:117). One of the most prevalent means of attaining power is through providing needed benefits which others cannot easily do without. Thus, when a client goes to an "expert" for services or help, he goes needing these benefits from the professional expert more so than the latter needs anything from the individual client in return. One of the reasons the professional's need of the client is less than vice versa, is that depending on the professional's employment setting, he holds himself--and his actions--accountable not so much to the client, as to his employer, firm or organization, professional association, colleagues, and so forth. Observation of this fact in a number of health and welfare settings prompted Stanton to conclude that in most service arenas, it is the clients' welfare that "comes last" (1970).

Of course, any professional must exhibit a minimum of expertise and concern for the welfare of his clients. Otherwise, clients may cease to utilize his services, bring law-suit against him, or damage his reputation to the extent that he cannot secure enough clients to sustain his professional activities. What are some of the options available, then, to the client who wishes to avoid the role of subordinate to the professional in a helping relationship? Blau, following Emerson (1962), notes that an individual has four alternatives.

First, if the client possesses enough strategic resources, he can offer the professional a service that the latter wants badly enough to offer his services in return. For instance, a client with great wealth may be able to secure needed services from a professional without becoming subordinate to him in the process--if the professional is interested in making money and if the client is willing to expend it. Exchanges of this type allow each side to retain their independence and the relation becomes one involving peer exchange rather than power.

Second, assuming there are alternative suppliers of the service, a client may seek the needed service elsewhere. A poor family, for instance, in need of extra cash for a crisis situation would have to approach a welfare agency as a subordinate, but might borrow from a relative as a peer. The disdain which most persons show toward dependence on welfare funds--even among those currently receiving them (see Grigg, et al., 1972)--may be accounted for by persons' preferences, in general, to avoid a relationship in which they must play the subordinate role.

A third option of the client is to coerce the professional to furnish the needed services or benefits, providing the client is able to do so. In effect, the use of compulsion or force to gain services would establish the domination of the client over the professional. While physical force or the threat of violence are prohibited--by both normative and legal standards--there are other means of coercion which are acceptable in our society. For instance, the recent organization of Welfare Rights and Senior Citizens groups to demand and procure needed social and medical services provides examples of specialized client groups who, in essence, are publicly disclaiming their subordinate role in the social and health service arenas.

The fourth possibility is that of doing without the needed service; that is, learning to get along without it or else finding some substitute for it. As Blau notes, taking this option would require that the clients change the values which determine their needs (1964:119). It may be that this is a tack currently taken by many persons in our society. The refusal of the poor and elderly to apply for public assistance--even when they qualify for it and need the money--or to visit a physician or go to a hospital--even though they are sick and could do so at society's expense--may be an example of this very option: getting along without a needed service, in order to avoid paying the price of subordinance to obtain it.

Experiments With a "Mixed-Motive" Social Simulation Game

In an effort to explore the effects of symmetry and goals on the professional-client relationship, two basic versions of a prototype, mixed-motive social simulation game were employed. The two game versions reflect different values of Blau's concept of symmetry (that is, the degree of commitment of the parties to the relation), which is taken here as the major independent variable in the social exchange process. Game Model I reflects an asymmetrical situation, where the professional has the advantage by virtue of his sole right to make behavioral decisions for the pair. Model II reflects a symmetrical situation, where neither professional nor client has a built-in advantage over the other, since the role of behavioral decider is determined by chance at the beginning of each round of play. An attempt was made to hold constant all other social and personal resources of the participants by having partners "match" on these before play of the game began. (For the steps in the "mixed-motive" game as related to sex-roles, see Osmond, 1970; and Osmond and Martin, 1973. The present game consists of an adaptation of the profile cards, conflict issues, and behavioral alternatives to the professional-client relationship).

Within each of the game models, variations were also made according to the goals of play. In one variation, we encouraged clients--and likewise, the professionals--to think only of their own welfare, while in the other we stressed the importance of the relationship per se, in addition to individual success. Essentially, this reflects an emphasis on relatively zero-sum goals versus relatively multiple-sum ones. Table 1 presents the four game-models utilized, showing variations on both symmetry and goals.

TABLE 1.--Game Models by Symmetry and Goals

Degree of Symmetry	Nature of Goals: Individual Only	Nature of Goals: Individual and Relationship
Asymmetrical (Model I)	IA. Asymmetrical, individual only	IB. Asymmetrical, individual plus couple goals
Symmetrical (Model II)	IIA. Symmetrical, individual only	IIB. Symmetrical, individual plus couple goals

Exchange theoretical principles would lead us to predict that players of version IA. (representing a potential power relationship with relatively zero-sum goals) would exhibit the least success in terms of total points scored and the greatest amount of exploitation (of the partner lacking an advantage by the partner with one). Players of version IIB. (representing a peer relationship with individual but also relationship goals) would be expected to achieve the highest individual and couple scores and to show the least amount of exploitation.

The specific questions of this research effort are as follows. (1) Does an asymmetrical relationship lead to greater exploitation of a client than a symmetrical one does? And, (2) can goals make a difference in the outcomes of the professional-client exchange process, independently of the symmetry of the relationship? These two questions reflect, in part, the first and fourth of Emerson (1962) and Blau's (1964) options for avoiding a dependent relationship (that is, strategic resources and values). Our experiments do not deal with the second and fourth possibilities--alternatives and coercion--though more is said of these in the discussion, following presentation of the results.

The Mixed-Motive Game

The "Mixed-Motive" game prototype is a social simulation game based on Blau's theory of social exchange. Structural elements are built into the game both by the role obligations of the players as well as by the game's rules. Cultural elements of relevance are reflected in the "goals" of the game, toward which the players' behavior is oriented. The major concepts of exchange theory are incorporated in the game as follows. (1) The game assumes that the interpersonal relationships being simulated are primarily extrinsic (on the "attraction" dimension) in character. (2) The "obligations" of social exchange remain unspecified, through the players' keeping secret their individual value-weightings on the conflict issues. (3) The major independent variable of the game is Blau's symmetry of the relationship, which is experimentally manipulated by altering the players' behavioral opportunities (via Model I and Model II). (4) The intervening variable in the theoretical model is the "degree of trust" between the professional and client. Though trust is not of central concern to the present study, it is an important aspect of the service-provision/service-receipt process and has been elaborated on elsewhere (see Bidwell, 1970; Martin and Osmond, 1973). Trust is incorporated into the game via the option of the "behaver" to violate agreements or demands ("to cheat"), and that of the "demander/checker" to check (and "punish") the behaver, if and when violations are suspected. (5) And last, the dependent variable of the theoretical and gaming models is the extent to which peer (versus power) relations (the "functions" of exchange) emerge from the interaction process.

The "mixed-motive" game can be played by any number of two-person dyads and requires three rounds to complete. Scores are posted at the end of each round of play, so that participants can assess their performance in relation to others playing a similar role. The game assumes a conflict of interests (and/or behavior preferences) between the client and the professional, but also a desire on the part of each to preserve the relationship. Given the conflicts of interest, it follows that some degree of compromise--coordination, cooperation--is necessary for the relationship to remain viable. The reward structure (or scoring system) of the game encourages the players toward a multiple-sum form of compromise (see Osmond, 1972). That is, a dyad--as well as an individual player--achieves its highest score if each member insists on his way on those issues of greatest importance to himself, but allows the other to have his way on issues of greatest importance to himself.

Players of all game models were instructed that "points achieved" in the game reflected success in meeting their goals. For clients, success consisted of receiving desired services; for professionals, fulfilling professional goals. Relationship goals were articulated as "achieving success in providing for client needs while enhancing the client's approval of and respect for the professional." In games where only individual goals were stressed, clients were instructed to compete only with other clients for success; and professionals, only with other professionals. Partners in all four game variations were explicitly instructed that they were not in competition with each other--thus our description of Models IA and IIA as only relatively zero-sum in comparison with Models IB and IIB. In the games where relationship goals were stressed, players were instructed that any dyad not scoring 1,000 points by Round 3 was failing in its efforts to have a successful professional-client relationship.

The Subjects and the Data

The subjects for this study consisted of 214 undergraduate students at a large southern university, enrolled in courses taught by one of the instructors in the 1972-73 school year. The courses ranged in nature from the sociology of the family to research methodology and statistics, and were taught by the authors in the Departments of Social Work and Sociology. Though the sample is small in size and nonrandomly selected, we hold that the fit of the data with the predictions of the theoretical model lends credence to its validity. Further, the results reported here exhibit a pattern consistent with data from other experiments utilizing the "mixed-motive" prototype game on the subjects of sex-roles and parent-child relationships (see Osmond & Martin, 1973; and Osmond, 1969).

The data utilized in the analysis consists of the actual scores which the players achieved and utilized as feedback during play of the game. "Success points" were self-recorded by each player at the end of each round of play, and scores for both individuals and dyads are utilized here as indicators of the conflict resolution strategies which they employed. Exploitation--of the client by the professional--is measured by the difference between the professional's score and the client's score, at the end of each round. A positive difference indicates that the professional was scoring higher than the client, and a negative one that the client's score was higher than the professional's. It is recalled that a successful strategy in the "mixed-motive" conflict resolution game would be indicated by an overall decrease in exploitation over the three rounds of play.

The Results

The data in Table 2 indicate that the symmetry of the professional-client relationship is indeed important in determining the functions of the social exchange process. By the end of the second round, players of the symmetrical game (Model II) were exploiting each other very little and the pattern held through the third round. In fact, in the last two rounds, clients were scoring--on the average--slightly higher than professionals. Players of the asymmetrical game, however, exhibit a pattern of increasing exploitation from the first to third rounds. Clients increased their exploitation of professionals from Rounds 1 to 2, while in the third round the professionals apparently asserted their advantage and shot ahead of the clients.[2] In fact, the size of the exploitation value in the third round of the asymmetrical game is larger than for any other round of either game model (42 points). The tendency to exploit, as reflected by the data of the asymmetrical game, seems to be "encouraged" by a relationship in which one member is more dependent than the other. Thus, the evidence suggests that clients would gain the most from their relationships with professionals if they had enough strategic resources to establish a peer relationship with them. Given that this is generally not possible, let us turn to an examination of the effects of goals.

TABLE 2.--Average Amount of Exploitation (of Client by Professional) By Symmetry Model and Round of Play

Round of Play	Model I: Asymmetrical (N=51)	Model II: Symmetrical (N=56)
1	-14	+34
2	-27	-3
3	+42	-10

The goals of the professional-client relation appear to have less of an impact on the functions of exchange than symmetry does. Table 3 indicates that by the third round of play, professionals are exploiting clients to some extent--regardless of whether goals were for individual success only or for both individual and relationship success. However, caution should be utilized in interpreting these data. In order to examine the effects of goals, we combined games with different structures (Models IA. and IIA.; and IB. and IIB.);

[2] The result that clients exploited professionals in the first two rounds of the asymmetrical game is paralleled by our data on sex-roles, involving male-female interaction. Blau's theory provides an explanation for this outcome. When persons have a built-in advantage--as the professionals do here--they are hesitant to use it, up to a point. However, when the occasion calls for it (and here, it is winning or losing the game), they will use their advantage and thus establish, or re-establish, the structure of the relationship.

thus, the effects of symmetry on exploitation patterns may well cover-up--or over power--the effects of goals of the partners.

TABLE 3.--Average Amount of Exploitation (of Client by Professional) By Goals of Game and Round of Play

Round of Play	Individual Goals Only (N=22)	Individual Plus Relationship Goals (N=85)
1	-37	+40
2	-35	0
3	+13	+8

The data in Table 4 clarify the picture to some extent. Here it becomes obvious that although the goals of the relationship have a systematic effect on exploitation, the evidence is not clear-cut. Comparing Models IA. and IB., we note that when a relationship is asymmetrical, having multiple-sum goals in addition to individual ones is associated with a reduced amount of professional dominance, by the third round of play. In fact, there is about one-half as much exploitation in Model IB. as in Model IA. (a difference of 28 points as compared to 52). These data provide an affirmative answer to the second question of this study, indicating that goals of a relationship can have an important influence on the functions of social exchange--which is independent of the symmetry of the relationship.

TABLE 4.--Average Amount of Exploitation (Of Client by Professional) By Symmetry and Goals, and By Round of Play

Round of Play	Model IA. (Asym., Ind) (N=15)	Model IB. (Asym., Both) (N=36)	Model IIA. (Sym., Ind) (N=7)	Model IIB. (Sym., Both) (N=49)
1	-51	+42	-5	+40
2	-5	-60	-99	+16
3	+52	+28	-71	+2

Questions are raised rather than answered, however, by a comparison of the two symmetrical models (IIA. and IIB.). In the game with both individual and relationship goals, exploitation by professionals decreases consistently from the first to third rounds; in fact, there is practically none at all by Round 3. In the game with individual goals only, however, exploitation increases from Rounds 1 to 3--but it is exploitation of the professional by the client rather than vice versa. We are unable to offer a satisfactory explanation for this result--if, indeed, one exists. The data are based on such a small N (only seven couples) that perhaps we should dismiss them as unreliable. However, they may indicate something of worth which, at the least, should be investigated by future research. When individuals accustomed to a subordinate role in a given type of relationship find they are now "equals" with their partners; and when these same persons have a goal of enhancing only their individual welfare, perhaps they pursue these goals with a certain amount of ruthlessness. This might constitute an instance of "oppressed" persons seeking revenge, once they become aware that their "oppressors" no longer enjoy an advantage over them. At any rate, the possibility that the results of game Model IIA. are meaningful deserves attention in future research on the effects of goals and symmetry on the social exchange process.

Discussion

Long, commenting on the welfare delivery system in this country has noted that ". . . the powerlessness of clients (customers) is not only dysfunctional for them [the clients] but is coming to be regarded as dysfunctional for the production of desired system states. Effective customers may be a necessary variable for the achievement of planned system states that are generally desired" (1970:202). The results of this study offer some insights into the social conditions which produce "powerless clients" and point us toward specific actions which will facilitate the emergence of "effective customers" in the health, education, and social service arenas. Specifically, we believe our data provide evidence in support of increased "accountability" of service-providers to the clients--or customers--whom they serve.

Our data indicate affirmative answers to both of the research questions posed. That is, (1) asymmetrical relationships result in greater exploitation of clients, by professionals, than symmetrical relations do. And, (2) given the typical asymmetrical character of professional-client relations (cf. Parsons, 1970:3; Bidwell, 1970:39; and Rosengren, 1970: 216), multiple-sum goals for the dyad's members result in less exploitation of the client than do goals of a relatively zero-sum nature. A conclusion suggested by the first result (which is directly related to Emerson and Blau's first option for avoiding the dependent role in a power relationship) is that clients can approach a service-provider on a peer basis if they are able to marshall enough strategic resources to offer needed services to the professional in return for those sought. Since professionals tend to acquire prestige and respect on the basis of the status characteristics of their clients, high status clients would have a valuable asset with which to bargain in the exchange process. However, as Rosengre has noted (1970:206), ". . . many clients are ill, infirm, very young, impoverished, undereducated, discriminated against, legally constrained, and otherwise unable to mobilize . . . resources on their behalf and on their terms." Thus, the chances for many persons in our society to escape the subordinate role in their relationships with professionals--or even to attenuate the effects of such asymmetrical relations--are minimal to zero.

Our second finding suggests a more plausible, and logically possible, alternative for improving the clients' bargaining position vis-a-vis the professional service purveyor. If we can encourage, or enforce, multiple-sum goals for professional-client relations, although the professional would retain the advantage in the relation (and thus remain in power), his tendencies to exploit clients would diminish. The primary responsibility for articulation and enforcement of such goals would ultimately rest with the professional--either on the organization for which he (or she) works or on the professional association to which his actions are currently held accountable (see American Hospital Association, 1973). Parsons (1970:8-10) in a comment on the effectiveness of professionals' decisions regarding solutions of client problems, notes the following. "Since, typically, the client is relatively low on power, this means the superordinated components of the organization must act in a <u>leadership</u> capacity to ensure . . ." effective decisions on behalf of the client. Such "responsible leadership" would best be facilitated by the institutionalization of a relevant set of "client-rights"--in the sense of "civil rights"--which would be recognized as legitimate by all parties involved. As Parsons further notes, "Client membership [in the professional-client relationship] is grounded in rights to the primary output of the system; 'staff' membership is grounded in <u>functional contributions to bring about that output</u>' [emphasis the authors'].

To encourage professionals toward such a recognition of client-rights--"<u>to the primary output of the system</u>," entailing "effective decisions on their behalf"--service and professional organizations might begin by making grants of social honor and other rewards contingent upon the <u>consequences</u> of service provision efforts. Such a strategy would logically include inputs and feedback from clients regarding feelings of respect, approval, and gratitude toward the professional. As Blau notes (1964), we are more likely to grant such "social rewards" to persons who treat us well than to those who do not. Thus, direct evaluation by clients should become an institutionalized aspect of the reward structure within which service purveyors practice. In essence, we conclude that "responsible leadership" of the superordinate professional organization would entail some elements of direct accountability of professionals to the clients whom they service. Extrapolating from the present research, while such accountability would likely not eliminate exploitation of clients by professionals, it would result in a significant reduction in the amount of such exploitation.

Specific possibilities for prodding service organizations to institute such accountability systems are several--ranging from the mobilization of public opinion, to the passage of specific laws, to the organization of client-groups for the purpose of pressuring recalcitrant organizations. General public dissatisfaction and pressures on law-makers--over failure of services to produce promised results; rising costs with no visible improvement in service quality, and so forth--have resulted already in legislative requirements that federally funded programs "account" for themselves in terms of demonstrable "outputs." On the client-level per se, two of Blau and Emerson's options (coercion and utilization of alternative services) seem pertinent. Collective organization of the clientele of various social service organizations might enhance professional responsiveness to client needs by, for example, waging effective publicity campaigns; calling for boycotts of certain agencies; or restricting patronage to the more effective organizations. A problem here, however, as noted by Bidwell (1970) is that the chances for clients to effectively organize are diminished in those organizations which service their clients seriatim--and where clients are non-members of the organization and thus interact with each other very little--as compared with organizations which service in "batches," where the clients are members (for example, schools, hospitals, prisons) and thus have greatly enhanced opportunities for collective organization and action. Nonetheless, even in agencies of the former type, special interest groups with specific goals have organized and in some instances had a significant impact on the programs against which they took action. (See, for example, Steiner's account of the National Welfare Rights Organization, 1971; also, see Orden, 1973; Shapiro, 1971; Kramer, 1969; Levitan, 1969; and Purcell and Specht, 1965).

Conclusions

The present study points to the need for further research into the conditions which attenuate professional dominance and which facilitate effective (and efficient) service provision to clients. Moreover, attention needs to be given to the extent to which presumed professional "authority"--that is, legitimate power--is in fact "granted" by clients, and to the actual role of client trust in the professional-client relationship (see Freidson, 1968 and 1970, on the "impurity of professional authority"; and Parsons, 1970, on the importance of client trust in professional-client relations). The conditions under which client grants of authority and trust flourish and/or wane should be investigated. For example, do these vary by: type of service being sought; by the characteristics of the service-provider's occupational setting (such as whether "free professional" or organizational bureaucrat; or whether in the health, social service, or educational arenas); by the social characteristics of the service-seeker (such as age, social class, race or sex); by the social characteristics of the service provider; and so forth. Answers to these questions require a comparative framework and call for the empirical investigation of several service-provision arenas at once.

Further, it is our hope that future research on professional-client relations will be conceptualized within a dynamic (or process) theoretical framework (as exemplified here by social exchange theory; or otherwise by conflict theory or general systems theory, etc.), and tested via a dynamic research method (as exemplified here by the employment of a social simulation game). This hope springs from our own dissatisfactions with typological theories and survey research methods; and from our enthusiasm over the rich potential of the social simulation gaming technique for theory construction and research (see Coleman, 1969; and Walaszek, 1972). Rather than having to rely on what people "say" they do (or have done), a method such as simulation gaming allows one, in essence, to monitor and observe the emergence of social organization--and thus to literally assess the amount of cooperation, exploitation, trust or mistrust as it occurs--within the structure of the interaction setting. While theorizing about professional-client relations is at a fairly advanced level, the dynamics of such relations have been little explored, and empirical data on the development and progression of such relationships are lacking. In closing, we concur with Parsons' comment that: "The theme of the nature and importance of solidarity, across the service-client line of service-rendering organizations thus seems . . . to be one of the most important with which social scientists who care about the future of society can concern themselves" (1970:16).

References

American Hospital Association.
1973 A Patient's Bill of Rights. Chicago, Illinois: American Hospital Association.

Bidwell, Charles E.
1970 "Students and schools: Some observations on client trust in client-serving organizations." Pp. 37-69 in, W. R. Rosengren and M. Lefton (eds.), Organizations and Clients. Columbus, Ohio: Charles E. Merrill Publishing Company.

Blau, Peter M.
1964 Exchange and Power in Social Life. New York: John Wiley and Sons.

Coleman, James S.
1969 "The methods of sociology." Pp. 65-93 in Robert Bierstedt (ed.) A Design for Sociology: Scope, objectives and methods. Philadelphia: The American Academy of Political and Social Science.

Emerson, Richard.
1962 "Power-dependence relations." American Sociological Review, 22 (February):31-41.

Freidson, Eliot.
1970 "Dominant professions, bureaucracy, and client services." Pp. 71-92 in W. R. Rosengren and M. Lefton (eds.), Organizations and Clients. Columbus, Ohio: Charles E. Merrill Publishing Co.

Goffman, Erving.
1961 Asylums: Essays on the Social Situation of Mental Patients and Other Inmates. New York: Doubleday Anchor Books.

Grigg, C. M., P. Y. Martin, M. G. Horton, and M. W. Osmond.
1972 A Follow-up Study of Four Rehabilitation Projects for Disabled Welfare Clients. Tallahassee, Florida: Institute for Social Research.

Kramer, Ralph M.
1969 Participation of the Poor. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Levitan, Sar A.
1969 The Great Society's Poor Law: A New Approach to Poverty. Baltimore: The Johns Hopkins Press.

Long, Norton.
1970 "Rigging the market for public goods." Pp. 187-204 in W. R. Rosengren and M. Lefton (eds.), Organizations and Clients. Columbus, Ohio: Charles E. Merrill.

Orden, Susan R.
1973 "The impact of community action programs on private social service agencies." Social Problems 20 (Winter) 364-81.

Osmond, Marie W.
1969 "COM-PAC: A two-person communication game." Mimeo.

1970 "The method of simulation games in family life education." Experimental Publication System, 9 (December):Ms.No. 346-45.

1972 "The simulation of rational exchange: An extension of Schild's model." Pp. 134-38 in Proceedings of the National Gaming Council's Eleventh Annual Symposium. Report No. 143, Center for Social Organization of Schools. Baltimore: Johns Hopkins University.

Osmond, M. W., and P. Y. Martin.
1973 "From closed to open-systems: Game simulation of sex-role behavior." Under review.

Parsons, Talcott.
1970 "How are clients integrated in service organizations?" Pp. 1-16 in W. R. Rosengren and M. Lefton (eds.) Organizations and Clients. Columbus, Ohio: Charles E. Merrill.

Purcell, F. P. and Harry Specht.
1965 "The house on sixth street." Social Work, 10 (October):69-76.

Rosengren, William R.
1970 "The social economics of membership." Pp. 205-22 in Rosengren and Lefton (eds.) Organizations and Clients. Columbus, Ohio: Charles E. Merrill.

Scott, Robert A.
1969 The Making of Blind Men. New York: Russell Sage Foundation.

Shapiro, J. H.
1971 Communities of the Alone. New York: Association Press.

Stanton, Esther.
1970 Clients Come Last: Volunteers and Welfare Organizations. Beverly Hills, California: Sage Publications.

Steiner, Gilbert Y.
1971 The State of Welfare. Washington, D. C.: The Brookings Institution.

Walaszek, Z. A.
1972 "Theory-games-reality." Pp. 60-73 in Proceedings of the National Gaming Council's Eleventh Annual Symposium. Report No. 143, Center for Social Organization of Schools. Baltimore: John's Hopkins University.

Weiss, Robert S.
1973 "Helping relationships: relationships of clients with physicians, social workers, priests and others." Social Problems, 20 (Winter):319-28.

A PRELIMINARY INVESTIGATION OF THE USE OF PRINCE -- A MAN-COMPUTER SIMULATION OF INTERNATIONAL RELATIONS -- IN HIGH SCHOOL COURSES

Steven J. Kidder, Ph.D.
Abt Associates Inc.
55 Wheeler Street
Cambridge, Massachusetts 02138

Richard E. Horowicz
Northern High School
2201 Pinwood Avenue, Zone 14
Baltimore, Maryland 21214

Gary M. Kiselewich
John Hopkins University
Baltimore, Maryland 21218

This paper reports on research designed to analyze the adaptability of a college-level man-computer simulation to the high shcool level. The simulated environment incorporated in this study was PRINCE (Programmed Inter-National Computer Environment). PRINCE is a man-computer simulation of international relations developed at Syracuse University by Coplin and O'Leary (1972). The application of PRINCE at the high school level also involved the development of a preliminary instructional model for the use of simulation games in classrooms. This paper reports on the use of PRINCE and the students' achievement in the international relations course.[1] Following a brief introduction to the PRINCE simulation, the paper continues with the Study Approach, Grades and Testing, Results, and Discussion.[2]

The PRINCE Model

As noted above, PRINCE is a man-computer simulation of international relations. The players assume the role of foreign policy maker for the United States and cope with various issues within a framework of domestic and international reactions.

The domestic component of PRINCE consists of various Policy Influencing groups (PI groups) which represent various political, economic and bureaucratic interests <u>within</u> the United States. The international component simulates the reactions of five nations (Russia, China, India, France, Pakistan) to the decisions of the U.S. policy-makers on different international issues. The issues themselves are stated in terms of a specific outcome which the players attempt to achieve or block, according to their interests.

---

[1]A brief description of the instructional model used in this study can be found in Appendix A. For a detailed description, see Kidder (1973a, 1973b).

[2]These sections are based on Report No. 153, "An Instructional Model for the Use of Simulation Games in the Classroom," by S.J. Kidder, R.E. Horowicz, and G.M. Kiselewich, Center for Social Organization of Schools, The Johns Hopkins University, May 1973.

Three basic types of decisions are made during the play of PRINCE; Issue Positions, Influence Attempts and Transaction Acts. The players make these decisions for the U.S. and the computer formulates these decisions for the five simulated nations. Issue Positions (IPs) state a nation's general attitude toward a specific issue and are rated on a scale of -10 (strongly disagree and will attempt to block the issue) to +10 (strongly agree and will attempt to achieve the issues as stated). Influence Attempts (IAs) are made by a nation to sway the Issue Position of another country so that it will more closely represent its own attitude on that issue. Influence Attempts can be friendly (+10) or range to unfriendly (-10). Transaction Acts (TRs) are economic moves made between countries in the form of AID (in millions of U.S. dollars) or RESTRICTION (restricting the natural flow of goods and services by a stated percentage).

These decisions are coded and run through the PRINCE program. New Issue Positions, Influence Attempts and Transaction Acts are formulated for the simulated nations and are given to the players for study. The reaction of the various Policy Influencer groups on specific individual decisions are given along with a conglomerate picture of the domestic reaction as expressed in a Public Opinion Poll. The PI groups rate individual actions on a scale of +10 (strongly approve) to -10 (strongly disapprove). The Public Opinion Poll shows the percentages of the U.S. "populace" that approve or disapprove of the players' overall performance. Additionally, the computer may make recommendations for future actions. All of the above is included on the computer output, which the players study as a basis for future decisions. Overall, players are attempting to resolve issues in their favor while maintaining satisfactory domestic and international relations.

Study Approach

The purpose of the study was to apply a controlled instructional approach to the use of simulations at the high school level in order to examine: (1) how the instructional model would fare in actual use, and (2) how the class using the model and game approach would compare to a traditionally-taught class.

The basic materials for a one semester course in International Relations were made available from the International Relations Program at Syracuse University. A thorough study of the Manual and background data suggested that further instructional materials should be developed. Issue packets containing current new articles that were relevant to the PRINCE issues were constructed for student use in the classroom. The students were divided into teams, to increase their motivation to operate effectively in the course. Each team received identical issue packets. The modified curriculum called for data on seven of the fourteen issues in the PRINCE instructional materials.

Lesson plans were written to introduce the students to the basic concepts of international relations, e.g., nationalism, sovereignty, power. The introduction took over a week's time. Following this, the rules and procedures for playing the simulation game were taught. Sample computer "dry runs" of the simulation were examined to prepare the students for the decision-making periods. Actual game playing began the following week, with the students' decision-making restricted to one issue. (See instructional model, above. It is important to begin the decision-making at a low conceptual level.) One new issue was added each subsequent week, thus increasing the complexity of the learning task over time. Additional aids were developed to facilitate playing the PRINCE game.

Three groups of twelfth grade students participated in the study. Group 1 received a traditional course in International Relations, Group 2 received the complete experimental course involving the PRINCE computer simulations; Group 3 (in another school, but taught by the same teacher) also received the experimental treatment. From the beginning of the study, it was assumed that there would be an increase in student ability from Group 1 (low), through Group 2 (medium) and Group 3 (high). An analysis of covariance was performed in order to determine the relationship between student ability and the effect of the instructional approach.

The experimental groups were separated into teams of five to eight players. One team member was chosen as a chairman and the other members were assigned other tasks, such as becoming an "expert" on a particular country or issue. The teams were given one day to research the new issue and another day to arrive at group decisions on the various actions that can be taken when playing PRINCE. Those decisions were then given to a programmer who handled the computer runs. (It was impossible for the students to interact with the computer directly.) While the computer runs were being completed, the students attempted to predict the effects of their decisions on the simulated international and domestic environments. (The act of prediction or becoming aware of the outcomes of various strategies has been emphasized as an important component of learning from simulation games. See Fletcher, 1971, p. 443.) In addition, the students compared strategies and talked about the issue in a general class discussion. This activity was followed by a discussion of the computer feedback in light of their predictions and class discussion. This process continued until all seven issues were being dealt with in the course.

Grades and Testing

Students were informed that grades would be based on a combination of their group effort (as reflected in the Opinion Poll on the computer feedback sheets) and by their own individual effort in class. A final exam was administered to all experimental and control groups at the close of the course. The exam consisted of 100 objective items (mostly multiple-choice with some matching) and four essays. The results of the data analysis are provided below. The experimental design involved a univariate analysis of covariance, with I.Q. as the covariate. The dependent variable was the student's score on the final exam.

Results

Table 1 contains the observed cell means for the Control Class, who received a conventional course in International Relations; Experimental Class I, who received the PRINCE instructional package; and Experimental Class II, who studied the PRINCE instructional materials in another school, taught by the same teacher. One readily observes the need for controlling I.Q.

Table 1. Observed Cell Means for Control and Experimental Classes

	I.Q.	Final Exam
Control	102.68	52.11
Exp. I	106.74	61.42
Exp. II	116.74	74.73

Table 2 contains the statistics for the regression analysis of I.Q. on final exam. Approximately 13% of the variance in final exam scores is accounted for by I.Q.

Table 2. Statistics for Regression Analysis of I.Q. on Final Exam

Variable	Square Mult R	Mult R	F	P Less Than
Final Exam	.135	.368	8.30	.006

*Degrees of freedom for hypothesis = 1
Degrees of freedom for error = 53

Table 3 contains the statistics for the analysis of covariance determining the relative effects of the Experimental I and II Classes versus the Control Class. The Experimental II Class resulted in a treatment effect

Table 3. Statistics for Analysis of Covariance:
Covariate is I.Q., Dependent Variable is Final Exam

EXPERIMENTAL I versus CONTROL

Mean Square = 4.31, F = .02, with 1 and 53 df, P less than .90

EXPERIMENTAL II versus CONTROL

Mean Square = 2048.44, F = 7.22, with 1 and 53 df, P less than .01

($p < .01$) even after the effects due to I.Q. have been eliminated. Thus, the model plus complex simulation game is only effective with above average students. Nevertheless, the differences remain even after the effects due to ability have been removed statistically.

Discussion

The experimental treatment increased class performance over a conventional approach to teaching international relations. However, the instructional model incorporated a man-computer simulation of high complexity, designed for college students, which seems to have dampened the effect of the model with average high school students. However, the study is exploratory; now that successful application of the model has been shown, future research should be conducted to determine the effect of the model with diverse simulation games, varied team structure and scoring techniques. All that has been examined here is the total effect of the model; the importance of these elements is yet to be determined. The model plus man-computer simulation game was most effective with the high ability students. Even though the effect obtained with average students was not statistically significant, it should be noted that they did successfully complete the course of instruction and obtained rather good grades, compared to the conventional class with average students. It is encouraging to find average ability high school students handling complex man-computer simulation games designed for college students.

Decision-making and problem-solving skills are important learning outcomes which were not examined in the present study, but may yield interesting results in future studies. The suggested instructional model emphasizes the importance of making decisions and predicting the effects of these decisions before feedback is received. Simulation games seem to provide a natural environment for "exercizing" such higher-level cognitive skills. The emphasis on these skills may be justified on the basis of their generalizability to new problem situations that require immediate decisions for resolution. In complex simulations, problems continually confront the participant while the solution rests on cogent decision-making. If students receive more instruction in these skills in simulated environments, perhaps their performance in real-life will improve.

Although the instructional approach emphasized in the present paper resulted in increased student performance, research must be conducted to determine the relative effects of each element within the model. The effectiveness of the model may have been due to the effects of the teams, the gradual increase in complexity of the model (for maintaining motivation), or the simulation game itself. A clarification of the effects of these elements within the model can be made with programatic research.

REFERENCES

Coplin, W.D., Mills, S.L., O'Leary, M.K., PRINCE: Participants' Guide, Concepts, Environments, Procedures, International Relations Program, Syracuse University, Syracuse, New York, March 1972.

Fletcher, J.L., "Simulation Games as Learning Environments," Simulation & Games, December 1971.

Kidder, S.J., "An Instructional Model for the Use of Simulations and Games in the Classroom," Abt Associates Inc., A paper presented at the American Educational Research Association meeting in New Orleans, 1973a.

Kidder, S.J., Horowicz, R.E., and Kiselewich, G.M., "An Instructional Model for the Use of Simulations and Games in the Classroom," Report #153, Center for Social Organization of Schools, The Johns Hopkins University, Baltimore, Maryland, December 1973b.

APPENDIX A
AN INSTRUCTIONAL MODEL FOR SIMULATION GAMES

To date, instructional models have dealt with the acquisition of knowledge by students. These models usually involve a clarification of instructional objectives, measures on the entering abilities of the students, the actual instruction, an evaluation, and feedback. It is tacitly assumed that the student is motivated to learn and that higher level thinking (application, analysis, synthesis, and evaluation) will be used and improved during a unit of instruction. The instructional model outlined below does not assume that students are always motivated to learn, nor that higher level abilities are called into play during most classroom experiences. The essence of the model is that instruction should consist of two main phases, the first concerned with the acquisition of basic skills and knowledge, and the second concerned with an application, elaboration, and liberalization of the first phase. This type of model differs from traditional instructional models because the second phase requires the use of higher level abilities of application, analysis, synthesis, and evaluation in an "applied" but simulated environment. The first phase consists primarily of traditional classroom approaches to teaching (lecture, discussion); the second phase consists of an experience with a simulation game that increases in complexity and involvement over time.

The two phases are developed in a way that reduces the effect of another major problem in most classrooms; namely, lack of motivation. The phases are structured so that learning in phase one will improve the student's functioning in phase two. That is, a student's performance in phase two (the game, or simulation) will improve if he understands all the information dealt with in phase one (the traditional classroom approach). Thus, the goal of optimum performance in the liberal phase (or any other goal embedded in the simulation or game) may sustain motivation to learn in the more traditional phase.

The basic steps involved in the model include: (1) determine student competence (entering behavior); (2) introduce the unit at broad conceptual levels; (3) introduce new concepts: gaming environment, team structure, scoring (based on performance criteria in simulation or game and class work) roles, and types of decisions to be made; (4) complete one round of decision making with model; (5) have students try to predict results of decisions; (6) inform students of their relative performance as teams and individuals; (7) discuss effects of students' decisions, determine their understanding, and clarify their misconceptions; (8) repeat steps 4, 5, 6, and 7 at the next higher conceptual level of model. Note that the basic curriculum phases into an "applied" curriculum during the students' experience with the simulated environment. Figure 1 provides a schematic representation of the initial model.

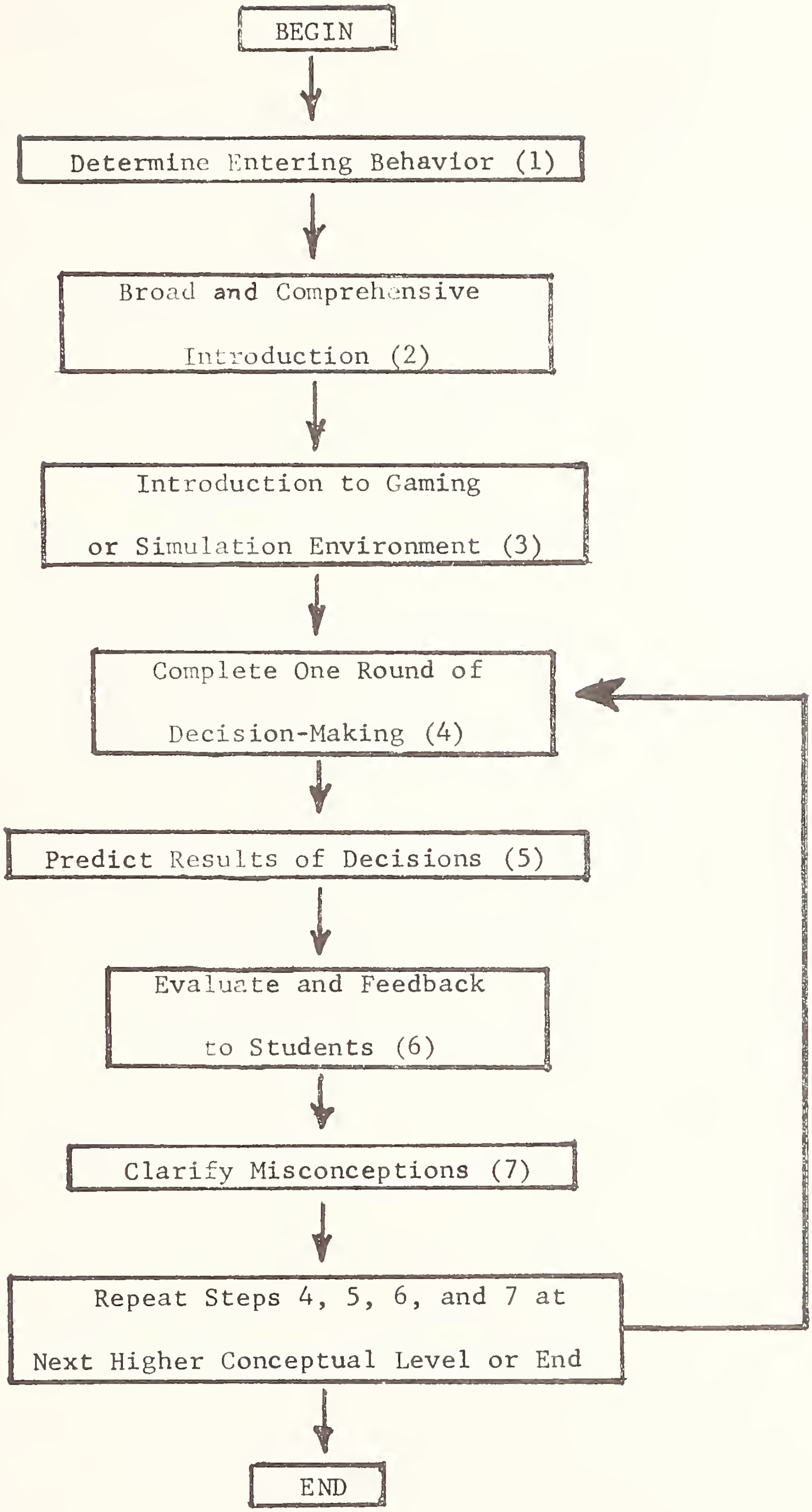


Figure 1. Schematic Representation of the Simulation and Gaming Instructional Model.

October 1, 1972

REPORT OF FIELD TEST
Obstacle Course: A Family Planning Delivery Services Game
John T. Foster, Dept. of Sociology, Florida A&M University, Tallahassee, Florida 32307

Overview

The early prototypes of Obstacle Course were played in undergraduate Social Welfare classes at the Florida State University. From this experience the author gained hueristically much information about the media and functions of the game. Modifications were made and more elaborate materials were then prepared.

This report of the first of two field tests has produced insight into game weaknesses and strengths in accord with the simulation evaluation strategy. Most of the concerns for the effectiveness of rules in causing players to perform properly were allayed. The role of judge, created after earlier trials, is of even greater importance than realized by the designer.

The game was played twice by eight groups of nurses and welfare workers at the Public Health Clinics of the Public Health Department, Polk County, Florida on September 25, 1972.

Description of the Procedures

Arrangements had been made on month prior (9/26/72) to the field test to cause participants to play without personal inconvenience or cost. The arrangements for play were located in comfortable rooms adjacent to the clinics and an informal, congenial atmosphere prevailed. The players had no other duties or interruptions during the game.

Players were encouraged to set at the table of their choice, to have some coffee, smoke if they wished and to read the players manual. No help interpreting the game was offered, but procedural questions received a courteous answer, "Look here in the rules."

After completing the first play of the game the group was urged to "play it again" and they did. Upon completing the second play the observer collected the judge's notes, added them to his notes and asked the players five questions (see "Player's Quiz"). The quizes were collected.

Four groups played at the Lakeland, Florida Clinic in the morning and four groups played at the Winter Haven, Florida Clinic in the afternoon of September 25, 1972.

The Data

Description of the Sample

Participants: 44 women, 2 men
25 Public Health Nurses
11 Welfare Workers
10 Others (paraprofessionals, midwife, med. librarian)
Average age: about 35
Age Range: about 21-60

Comments: The field test participants were quite divided in what appears to be their aptitude as gleened from nondescript observation. The nurses were typically bright and alert; the welfare workers were polite and cooperative; and the paraprofessional personnel employed to contact family planning clients in the field (outreach) were quiet and threatened by the necessity to read aloud. Age and sex seemed to have no affect on player behavior.

Description of Time elements (speed of play)

Group	No. of Players	1st Play	2nd Play	Total time
#1	6	45	25	75'
2	6	30	30	60'
3	6	35	25	60'
4	6	25	30	55'
5	5	-	-	-
6	5	-	-	-
7	5	30	25	55'

Post Test Results

Group	Score: Cognitive Achievement #1	#2	#3	Total	Score: Attitude	Vocation
#1	3	4	4	11	0	PHN
	2	0	3	5	+	PHN
	1	0	2	3	+	PHN
	1	2	3	6	+	PHN
	1	0	0	1	0	SW
	3	0	0	3	-	PHN
mean				4.8		
#2	4	4	3	11	0	SW
	4	3	2	9	+	SW
	4	3	1	8	+	SW
	2	2	4	8	-	SW
	4	4	3	11	+	SW
	3	3	1	7	0	ORW
mean				9		
#3	2	1	4	7	-	PHN
	3	2	4	9	-	Midwife
	4	3	3	10	0	ORW
	2	2	3	7	+	PHN
	4	4	4	12	0	PHN
	4	4	2	10	+	PHN
mean				9.2		
#4	3	4	3	10	+	SW
	4	3	4	11	+	PHN
	1	3	2	6	+	ORW
	3	3	3	9	+	SW
	1	3	3	7	+	PHN
	1	3	2	6	+	SW
mean				8.2		
#5	0	0	2	2	-	ORW
	2	2	2	6	0	ORW
	3	2	2	7	-	PHN
	2	3	3	8	-	PHN
	3	3	3	9	0	PHN
mean				6.4		
#6	2	3	3	8	+	PHN
	2	3	3	8	+	Med. Bookk
	2	3	3	8	-	ORW
	2	2	4	8	+	PHN
	3	1	3	7	+	PHN
mean				7.8		
#7	1	2	2	5	+	PHN
	2	3	1	6	+	PHN
	1	2	0	3	+	SW
	2	3	2	7	+	PHN
	3	3	3	9	+	PHN

Group	Score: Cognitive Achievement #1	#2	#3	total	Score: Attitude	Vocation
#8	3	2	3	8	+	SW
	4	3	2	9	+	Nutritionist
	3	2	3	8	0	PHN
	1	2	0	3	+	PHN
	3	4	4	11	-	PHN
	4	4	4	12	0	PHN
	4	2	4	10	0	PHN
mean				8.7		
	2.7	2.34	2.33	7.55	+ 0 - 22 12 8	

PHN = Public Health Nurse

SW = Social Welfare Worker

ORW = Outreach Worker

Description of the Emotional Reactions of players as they read the cards

Note: The cards provide the actual language of disgust and despair employed by clients and the game puts players in frustrating situations.

1. The emotions ranged from nervous laughter to utterances made with conviction. Most players choose a card with serious anticipation after having read one or two.

Comments: An assessment of the data in the table above suggests that only a very small relationship between mean total scores of groups and dispositions of groups could exist. In rank order of scores:

Gr.	X Cog	X Dis
#2	9.3	+
#3	9.2	0
#8	8.7	+
#4	8.2	+
#6	7.8	+
#5	6.4	-
#7	6.0	+
#1	4.8	+

one might conclude that some relationship exists between cognitive achievement and disposition. The total data pertaining to dispositions are

+	0	-
22	12	8

PHN Performance

Disposition	Number	Mean Cog. Ach.
+	15	8.8
0	6	10.3
-	5	7.2
	26	9.14

Comments: It would appear that there is no relationship between cognitive achievement, on the first three questions, and positive or negative dispositions towards playing the game. With Public Health Nurses, neutral dispositions tend to be linded with high scores by members of this profession.

SW Performance

Disposition	Number	Mean Cog. Ach.
+	8	16.5
0	2	6.0
-	1	8.0
	11	13.81

Comments: A positive relationship appears to exist between disposition toward the game and cognitive achievement of Social Welfare workers.

"Others" Performance

Disposition	Number	Mean Cog. Ach.
+	3	11.0
0	4	7.75
-	2	5.50
	9	8.33

Comments: In this trial a relationship does seem to exist between dispositions and cognitive achievement yet this is affected by the diverse backgrounds of the nine subjects. To be neutral rather than positive or negative appears to be destructive to learning.

Comparison of Players by Vocation

Social Workers responded in a more favorable manner to Obstacle Course than other professionals. That is 73% of this group expressed positive dispositions about it while only one person was negative. This latter individual, who is employed as a social worker, does not have formal training in this area.

In harmony with their longer academic records social workers had higher mean cognitive scores than nurses and others. The lowest scores are associated with the least educated segment.

It also seems relevant to note the high incidence of neutrality and negativism among the heterogeneous "Other" category. Obstacle Course was not well received by the midwives, outreach workers, and etc.

The nursing position displayed a mixed reaction to simulation with 15/26 positive, 6/26 neutral, and 5/26 negative.

General Comments of Observers

1. The number of response cards should be doubled to maintain the curiosity of players and enlarge the number of (disgusted) responses to be read aloud.

2. An unrealistically small number of clients dropped out to Rocky Road.

3. A better system of recording client actions and game results by the judge needs to be devised.

4. The observer's schedules need to be revised by omitting many of the functional expectations which were overwhelming by complied with.

5. Clients should pay the $350 immediately upon having a child.

6. The child birth payment schedule should be revised.

Recommendations for improvement of the game

I. The application of two accreditation type evaluation models to Obstacle Course should be considered. The field test coordinator should interview casually at least one very alert person to determine the extent that the game is "Optimum" for players as well as "Useful" and "Appropriate".

   A. Harlod Larrabbie's "Optimum Conditions for Observing"
      1. Nature of Subject Matter
      2. Access to Subject Matter
      3. Observer's Sensory Equipment
      4. Observer's Perceptual Equipment

   B. Eugene Mechon's "Criteria for Evaluating Simulations - Adopted"
      1. Usefulness
         a. Scope
         b. Precision
         c. Power
         d. Reliability
      2. Appropriateness
         a. Isomorphism
         b. Compatability
         c. Redictiveness
         d. Purposefulness

II. Change in Media

   A. The boards should be surfaced to prevent marking and arranged to fold up.

   B. Double the number of response cards and make a large number Rocky Road antecedents.

C. Prepare a Judge's Report Form to cue judges, tabulate client data and record game results.

D. Color code response cards which direct players to go to Rocky Road.

III. Change in Rules

A. A player should only pay $250 for each child and the "birth schedule" should be changed to

5th roll - add one child

10th roll - add one child

15th roll - add one child

Recommendations for Second Field Test

1. Modify the game board and player instruction in accordance with remarks above.

2. Increase the number of verbal response cards.

3. Prepare a "Judge's Log" form that will possess three provisions to aid in data collections:

   a. A simple checkoff system to note the number of the die rolled by each player at each turn.

   b. Cues for the judge to remind him/her to enforce key rules.

   c. Fill-in blanks to record date, place, time of play (start-stop).

4. Prepare a short "quiz" to be administered by the game moniter immediately after the second play of the game. A tabulation (data recording) form should be included to aid the Field Test Coordinator.

5. Conduct the second field test in at least 12 clinics representing a full range of conditions existing in the Family Planning Delivery System in the state.

Analysis of Data

Summative

Upon completing the second field test, which will take 2-4 months, the data should be placed in a format appropriate for automatic data processing.

Independent variables (age, vocation, etc.) will be compared to dependent variables (cognitive achievement, cognitive growth, interest satisfaction, coping, disposition toward client behavior, etc.) by using both parametric and nonparametric statistical analysis.

Formative

Mediating variables (frequency of turns in getting to the clinic, on the "Dropout Road," and in the clinic; and frequency of turns in "Rocky Life" and "Freedom Circle") will be compared with independent and dependent variables through analysis of variance techniques.

SIMULATION: AN ANALYSIS OF STUDENT COGNITIVE RETENTION AND STUDENT TEACHER AFFECTIVE PERCEPTIONS

Charles H. Postma
Division of Secondary Education
Ashland College, Ashland, Ohio 44805

Jay C. Thompson, Jr.
Area of Curriculum and Instruction
Teachers College, Ball State University
Muncie, Indiana 47306

INTRODUCTION

During the 1972-73 academic year, 295 students and six teachers participated in a project[1] which attempted to measure the effect of simulation on students' cognitive retention and pupil-teacher affective perceptions of the learning experience. The primary purposes of the study were:

1. To determine, in a field testing environment consisting of twenty-five hours of treatment, what effect the use of simulation in high school United States History classes had on students' cognitive retention of facts, concepts, and principles.
2. To determine what effect simulation had on students' affective perceptions of the learning process in which they were involved.
3. To determine what effect simulation had on participating teachers' affective perceptions of simulations as pedagogical tools for learning.

The investigation utilized a multivariable technique to determine what effect simulation had on students' cognitive retention and affective perceptions of the learning experience. A multivariable technique was also utilized to determine the participating teachers' perceptions of simulation as a pedagogical tool.

DISCUSSION OF PREVIOUS RESEARCH

Previous studies pertaining to simulation and its effect on the affective and cognitive processes were inconclusive and contradictory. Much of this research therefore is difficult to analyze. Many of these studies confined themselves to laboratory settings rather than field testing situations; therefore, the environments were carefully controlled by the researcher. Some researchers used self-designed simulations or "pet games" to test their hypotheses concerning simulation and learning. Other researchers used participants who were above average in academic achievement. In a few cases the experimental treatment period

---

[1]This paper is a brief description of the research conducted. Additional data and information is available from the authors.

was not sufficiently long enough to justify "conclusive" results. In other research the researchers taught both the control and experimental classes rather than using classroom teachers. Also a number of the research designs did not incorporate a delayed interval post-test; those studies that did, frequently allowed too short a time between the post-test and delayed interval post-test. Nevertheless, in deference to these limitations several interesting findings emerged from the research.

Baker (1968)[2] and Anderson (1970) found that the simulation technique did enhance cognitive achievement and retention. Baker using junior high school students, reported that students involved in simulation learning activities, when compared with students taught through a traditional method, demonstrated a superior degr of cognitive retention on a delayed interval post-test measure. Anderson, using high school students, contended that students' ability to answer factual questions was enhanced as effectively by simulation activities as by traditional classroom teaching activities.

McKenney and Dill (1966), Garvey and Seiler (1966), Wing (1966), Heinkel (1970), and Wentworth (1972) reported that simulation activities did not enhance the students' ability to retain cognitive knowledge. McKenney and Dill concluded that simulation experiences were not enough as students tended to play "conservative strategies" and this detracted from long term learning. Garvey and Seiler maintained that the control group students scor ed higher on the post-experimental test than did the students in the experimental group using simulation. Wing's study revealed no significant difference in the amount of learning that had occurred between the traditionally taught students and those that were taught through the method of computerized simulation. Heinkel reported no significant difference between the achievement scores of the experimental (simulation) group and the contro (lecture-discussion) group. Wentworth found that students' ability to learn economics had been significantly retarded by their participation in the game.

Research studies conducted by Boocock (1963), Cherryholmes (1963) and Robinson, Anderson, Snyder, and Snyder (1966) found that simulation participants demonstrated more interest in simulation exercises than in traditional learning activities. These researchers concluded that participants did demonstrate a high degree of interest and reacted very positively to simulations.

2See complete citation of previous research in References.

Hall and Shirts (1961), Anderson (1966), Cherryholmes (1966), and Boocock (1966) concluded that students demonstrated a significantly higher degree of motivation when taught by the simulation method. Edwards (1971) and Harpstrite (1971) reported that the use of simulation increased the motivational level of students who were enrolled in a normal school environment. Harpstrite also concluded that teachers who used simulation techniques perceived simulation as being an innovative teaching method and an important pedagogical tool.

METHODOLOGY

The subjects who participated in the study were eleventh grade students attending five high schools in Indiana. The subject population at the inception of the study consisted of 295 students of which 160 were females and 135 were males. One hundred forty-two students were enrolled in the control classes and 152 were enrolled in the experimental classes. The subjects in the twelve classes (six control classes and six experimental classes) had a mean I.Q. score of 106 and were grouped as general ability students.

To obtain a socially diverse subject sampling, three socially different school populations were selected. Four classes consisted of students whose environment was categorized as rural-small town. These subjects lived primarily on farms in towns with a population of 10,000 or less. Four classes consisted of subjects whose social environment was categorized as medium size city population. The socio-economic background of these subjects was lower class to middle class, and they lived in a city with a population of 85,000. The remaining four classes consisted of subjects who lived in a major metropolitan area within the state of Indiana. These subjects came from a lower class to upper middle class socio-economic background. They lived in a city with a population of over 170,000.[3]

Six teachers, one female and five males, who were not skilled in the use of simulations, volunteered to participate in the study. The teachers were veteran teachers; each had three or more years of teaching experience and five of the teachers had completed the Master's Degree.

Twelve classes in the five high schools were chosen by the researchers to participate in the study. Six classes were randomly assigned as control classes and six classes were randomly assigned as experimental classes.

---

[3]This aspect of the data has not been analyzed at the time of this writing.

The study was structured around a five-week (25 classroom hours) experimental treatment period. During this period of time, the experimental subjects were taught United States Domestic History (1870-1915) through the use of simulation games.[4] The control subjects were taught the identical period of United States Domestic History through the use of a lecture-discussion teaching format. Both the control and experimental classes were assigned the normal textbook readings as a supplement to the teaching methodologies.

Each of the six teachers involved in the study taught a control class and an experimental class. This procedure was utilized by the researchers as a control for the teacher variable. Prior to the beginning of the experimental treatment period, each teacher received instruction in the use of the three simulations. This in-service training consisted of working through the procedures for playing the games, the goals of each simulation exercise, and the utilization of debriefing sessions at the conclusion of each simulation.

The teachers were instructed to assign the students in the experimental and control groups the normal textbook readings. The lectures in the control classes were derived from readings and the textbook material. The teachers spent part of the period each day lecturing and the discussion evolved out of the lecture and textbook material. This procedure was a normal pattern for the control classes during the five weeks. The experimental classes spent the entire period using the three simulations and debriefing them. During the period of the delayed interval, each teacher was instructed to return to their normal classroom procedures and not to utilize the simulation technique.

For the purpose of testing the stated objectives of the study, four null hypotheses were developed. The hypotheses were stated as follows:

1. At the conclusion of a five-week experimental period, there will be no significant difference between the control group (lecture-discussion format) and the experimental group (simulation format) on a measure of cognitive achievement.
2. Following a delayed interval of ten weeks, at the conclusion of the experimental period, there will be no significant difference between experimental and control groups on a measure of cognitive retention.

---

[4]Three commercially packed simulations were utilized in the experimental classes, The three simulations were: "The Game of Farming," High School Geography Project: Manufacturing and Agriculture (Toronto: The MacMillan Co., 1969); "Promotion," American History Games (Cambridge: Abt Assoc., Inc., 1970): and The Cities Game (Del Mar, California: Communications, Research, Machines Inc., 1970).

3. At the conclusion of a five-week experimental period, there will be no marked difference between experimental and control groups on a measure of affective perception.

4. Following a delayed interval of ten weeks, at the conclusion of the experimental period, there will be no marked difference between experimental and control groups on a measure of affective perception.

The testing procedure consisted of a pre-test, post-test, delayed interval post-test sequence. The Cognitive Achievement Instrument[5] and the Student Affective Perception Instrument were utilized for the three testing periods. The Cognitive Achievement Instrument included thirty questions concerning industrialism, agriculture, politics, cities, social problems, and domestic reform. This instrument had a reliability factor of .7971. The Student Affective Perception Instrument consisted of twenty-eight response items. These questions were designed to measure the experimental and control students' affective perceptions of the two teaching methods. The rationale for the creation of this instrument was identical to the rationale utilized in the creation of evaluation instruments by the Ball State University Curriculum Evaluation Team. This evaluation model suggested that "an evaluation must be based on a description of what pupils and teachers and other professional personnel think is happening in schools."[6]

The Teacher Perceptions of Students and Teacher Behaviors Instrument consisted of thirty-six response items. These questions attempted to measure the teacher's perceptions of the student and teacher behaviors in the experimental and control classes.[7]

Fifteen percent of the total number of students in the experimental and control classes were personally interviewed by the researchers and their verbal responses recorded. The questions

---

[5]All instruments were developed by the authors and field tested prior to their use in the research design. All instruments were based on models used by the Area of Curriculum and Instruction, Ball State University, in program evaluation.

[6]Richard C. Kunkel and James H. McElhinney, "A Rationale for the Evaluation of Curriculum," (Unpublished paper, Ball State University, 1970), 5.

[7]The rationale for the creation of this instrument was identical to the rationale utilized in the creation of the Student Affective Perception Instrument.

utilized were parallel to those included in the Student Affective Perception Instrument. The ten questions in this interview allowed the randomly selected students to verbalize their perceptions of the classroom activities which occurred during the treatment period.

Twelve administrative and guidance personnel were asked to observe the control and experimental classroom activities. The observers were not told which groups of students were participating in the experimental or control group activities. Each observer was requested to attend the class sessions in his building at least twice during the treatment period and to record his observations on the In-Classroom Observation Instrument continuum.[8]

Analysis of the data was computed to determine the significance of difference for Null Hypotheses One and Two by means of the Univariate and Multivariate Analysis of Variance and Covariance Program Package.[9] This prepared program allowed the researchers to obtain adjusted mean scores and F-ratios for the Post-test and Delayed Interval Post-test variables of treatment and sex.[10]

For the collected data regarding Hypotheses Three and Four, frequencies and percentages were used in order to facilitate the description of model responses, such that potential differences between the groups being compared might be readily identified and localized. A difference spread between groups of ten percent or more was judged to be a meaningful index of marked difference.[11]

Because of the insignificant number of computations required on the Teacher Perceptions of Student and Teacher Behaviors Instrument, the researchers tabulated these responses manually. The data collected on the In-Classroom Observation Instrument was tabulated and all frequencies of responses reported. The verbal responses collected on the Student Interview Instrument were summarized and the most frequent responses reported.

---

[8]A minimum of twenty observations were necessary for this instrument.

[9]Univariate and Multivariate Analysis of Variance and Covariance Program Package (Buffalo: Computing Center, State University of New York, 1968).

[10]The two covariates in this computation procedure were pre-test scores and I.Q. scores.

[11]Each item on the Student Affective Perception Instrument was dealt with individually. Hypotheses Three and Four were supported or rejected for each item at a difference spread of ten percent or greater. Such a difference was considered to be a marked difference sufficient to reject the hypotheses.

COGNITIVE RESULTS

Null Hypotheses One was supported. On the basis of the treatment applied, it was evident from the F-ratios that no significant difference between the experimental and control groups occurred at the .05 level on the post-test measure of cognitive achievement for the variables of treatment and sex.

Table 1

ANALYSIS OF COVARIANCE TABLE SHOWING THE RESULTS OBTAINED FOR HYPOTHESIS ONE

Source	SS	DF	MS	F	P(.05)
Treatment	0.0661	1	0.0061	0.0005	0.9824
Sex	0.7219	1	0.7219	0.0583	0.8095
Error	2923.568	236	12.388		

*Significant at .05 level.

Table 2

ANALYSIS OF COVARIANCE TABLE SHOWING THE RESULTS OBTAINED FOR HYPOTHESIS TWO

Source	SS	DF	MS	F	P(.05)
Treatment	949.3708	1	949.3708	63.2476	0.0001*
Sex	11.4844	1	11.4844	0.7651	0.3826
Error	3542.360	236	15.010		

*Significant at the .05 level.

Null Hypothesis Two was rejected. The F-ratio of 63.2476 was large enough to indicate a significant difference beyond the .05 level. That is, there was a significant difference between the experimental and control groups on the delayed interval post-test measure of cognitive achievement. This significant difference favored the experimental group. However, no significant difference at the .05 level occurred in the variable of sex.

The data reported in Table 1 and 2 supported the following conclusions:

1. Students in United States History classes where a simulation teaching method is used perform as well on a post-test measure of cognitive achievement of facts, concepts, and principles as do students in United States History classes where the traditional lecture-discussion teaching method is used.
2. Students in United States History classes where a simulation method is used perform significantly better on a delayed interval post-test measure of retention of cognitive achievement of facts, concepts, and principles than do students in United States History classes where the traditional lecture-discussion method is used.
3. Students in United States History classes where either a simulation method or a traditional lecture-discussion method is used do not perform differentially according to sex on post-test or delayed interval post-test measures of cognitive achievement of facts, concepts, and principles.

It is evident from the data, that simulations do have potential to facilitate student cognitive achievement and retention in social studies classrooms. It is important to note that both sexes benefited in the cognitive domain from the utilization of simulation in the daily activities of the public school classroom.

AFFECTIVE PUPIL-TEACHER RESULTS

It was evident from the data collected on the twenty-eight item Student Affective Perception Instrument that Hypothesis Three was rejected for sixteen response items. Each of these items revealed a marked difference between the control and experimental groups of ten percent or greater and the data for each of the sixteen items favored the experimental group.

The data supported the following conclusions:

Students in United States History classes where a simulation method is used report:

1. Markedly more active classroom participation than do students in United States History classes where the traditional lecture-discussion method is used.

2. No marked increase in their time spent preparing for daily classroom activities.

3. Markedly more interest toward the subject of history than do students in United States History classes where the traditional lecture-discussion teaching method is used.

4. No marked increase in their use of library materials.

5. Markedly more positive attitudes toward the teaching method being used than do students in United States History classes where the traditional lecture-discussion teaching method is used.

6. More marked attitudes favoring learning useful knowledge by working together in peer groups than do students in United States History classes where the traditional lecture-discussion method is used.

7. No marked increase in their reading of outside materials related to the topics studied in the class.

8. Markedly increased enjoyment of working with the classroom materials; whereas, students in United States History classes where the traditional lecture-discussion method is used do not.

9. Markedly increased positive opinions that they have acquired a variety of historical information upon which to base their judgments; whereas, students in United States History classes where the traditional lecture-discussion method is used do not.

10. A more marked increase in the exchange of ideas and information with their peers than do the students in United States History classes where the traditional lecture-discussion method is used.

11. A more marked increase in their active participation in their own learning process than do students in United States History classes where the traditional lecture-discussion method is used.

12. Females and males perceive differentially some aspects--such as learning useful knowledge from peers, classroom participation, enjoyment of history, and interest--of the learning experience.

It was apparent from the data collected on the Student Affective Perception Instrument that Hypotheses Four was rejected for twelve response items. Each of these items revealed a marked difference between the control and experimental groups of ten percent or greater and the data for each of the twelve items favored the experimental group.

The data supported the following conclusions:

Students in United States History classes where a simulation method is utilized report:

1. Markedly decreased active classroom participation upon return to the traditional teaching method.

2. Markedly decreased interest toward the subject of history upon return to the traditional classroom methods.

3. Markedly more negative attitudes toward traditional teaching methods being used upon return to such methods.

4. A marked decrease in attitudes favoring the traditional teaching methods upon return to the experience of the traditional methods.

5. Markedly decreased enjoyment of working with the classroom materials upon return to the experiences of the traditional methods.

6. Markedly decreasing their exchange of ideas and information with their peers upon return to the experiences of the traditional methods.

7. Markedly decreasing their active participation in their own learning process upon return to the experiences of the traditional methods.

Analysis of the data collected from the six teachers on the Teacher Perceptions of Student and Teacher Behaviors Instrument supported the following conclusions:

1. Teachers of United States History classes who use the simulation teaching method perceive simulation as a valuable pedagogical tool.

2. Teachers perceive more about the varied abilities of their students.

3. Teachers perceive the simulation method as one which allows students a better opportunity for self-expression and divergent thinking than does the more traditional method of lecture and discussion.

It was evident from the data that the simulation teaching technique was a useful pedagogical tool for motivating content interest, classroom participation, problem-solving, and self-expression. Simulation activities allowed students to internalize through realistic situations their learning experiences. These realistic situations created environments in which students did practice decision-making and problem-solving skills. The simulation technique assisted in creating a more personalized environment within the classroom; it was evident from the data collected in this study that both sexes bendfitted in the affective domain from the utilization of classroom simulations.

SUMMARY AND CONCLUSIONS

The data collected for the present study, regarding cognitive achievement and retention, supported the findings of Baker and Anderson. The present study was not supportive of the reported studies of McKenney and Dill, Garvey and Seiler, Wing, Heinkel, and Wentworth. It was apparent from the data that students involved in simulation learning activities, when compared with students taught through a traditional method demonstrated a superior degree of cognitive retention on a delayed interval posttest measure.

The findings of the present study concerning student motivation and interest supported previous findings of Boocock, Cherryholmes, Robinson, Anderson, Snyder and Snyder, Hall and Shirts, Edwards, and Harpstrite. It was apparent from the findings of the present study that students exposed to simulation activities were more willing to participate in classroom activities and to increase markedly their responses to teacher asked questions than were traditionally taught students. The students exposed to simulation demonstrated a marked increase in positive attitudes towards the teaching method being used in their classroom. The students exposed to the simulation teaching method reported that learning in peer group situations was important and that useful knowledge could be learned from their peers. The findings also supported the conclusion that students involved in simulation activities increased their interest in classroom activities, increased their enjoyment of classroom activities, and increased their interest in subject matter and content. In addition, the researchers found that participating teachers perceived simulation as being a valuable pedagogical tool and innovative teaching method.

REFERENCES

Anderson, Lee. Combining Simulation and Case Studies in the Teaching of American Foreign Policy. Evanston: Northwestern University, 1964.

Boocock, Sarane S. and Schild, E. O., ed. Simulation Games in Learning. Beverly Hills: Sage Publications, Inc., 1968.

Boocock, Sarane S. "An Experimental Study of the Learning Effects of Two Games with Simulated Environments." American Behavioral Scientist, X (October, 1966), 8-17.

Cherryholmes, Cleo H. "Some Current Research on Effectiveness of Educational Simulations: Implications for Alternative Strategies." American Behavioral Scientist, X (Oct, 1966), 4-7.

Edwards, Keith. Students' Evaluations of a Business Simulation Game as a Learning Experience. Report No. 121. Baltimore: Center for Social Organization of Schools, 1971.

Garvey, Dale M. and Seiler, William H. A Study of Effectiveness of Different Methods of Teaching International Relations to High School Students. Emporia: Kansas State Teachers College, 1966.

Harpstrite, James J. "An Analysis of Selected Simulation Games and the Assessment of the Subjective Feelings of Students and Teacher's Who Use Simulation Games in Social Studies Instruction." Unpublished Doctoral Dissertation, Michigan State University, Lansing, 1971.

Heinkel, Otto A. "Evaluation of Simulation as a Teaching Device." The Journal of Experimental Education, XXXVIII, 3 (Spring, 1970), 32-36.

Kunkel, Richard C., and McElhinney, James H. "A Rationale for the Evaluation of Curriculum." Unpublished paper, Ball State University, Muncie, 1970.

McKenney, James L. and Dill, William R. "Influences on Learning in Simulation Games." American Behavioral Scientist, X. (November, 1966), 5-9.

"Promotion", American History Games. Cambridge: Abt Associates Inc., 1970.

Robinson, James A., and Anderson, Lee F., Snyder, Margaret G., and Snyder, Richard C. "Teaching with Inter-Nation Simulation and Case Studies." The American Political Science Review, LX (March, 1966), 53-65.

The Cities Game. Del Mar, California: Communications, Research, Machines Inc., 1970.

"The Game of Farming." High School Geography Project: Manufacturing and Agriculture. Toronto: The MacMillan Co., 1969.

Thorpe, Gerald L. "A Brief Survey of Research in Learning Through the Use of Simulation Games." The High School Journal, LIV (April, 1971), 454-468.

Univariate and Multivariate Analysis of Variance and Covariance Program Package. Buffalo: Computing Center, State University of New York, 1968.

Wentworth, Donald R. and Lewis, Darrell R. "A Review of Research on Institutional Games and Simulation in Social Studies Education." Social Education, XXXVII (May, 1973), 432-440.

Wing, Richard. "Two Computer-Based Economic Games for Sixth Graders." American Behavioral Scientist, X (November, 1966), 31-34.

SIMULATING AN URBAN SCHOOL AND COMMUNITY FOR USE IN TEACHER EDUCATION

Frank P. Diulus
Department of Foundational Studies
S.U.N.Y. College at Buffalo
Buffalo, New York 14226

The author has designed a role play simulation game of the urban school and community in crisis, and this interactive simulation, entitled _The Three Rivers School Simulation Game_, has been employed in several teacher education courses. In this paper the design process and product will be briefly described. This essay will especially focus on the results of action research on two groups' playing of the simulation game. Empirical research on the kinds and frequency of learnings promoted by the playing of the simulation game indicate that students experienced dynamic processes of a typical urban school and community and they practiced behaviors in a safe context. Action research demonstrates that students clarified attitudes toward self, others, the teaching profession, and issues in school and society. There is also evidence of significant skill development in interpersonal communication, negotiation, decision making, and problem solving. The action research suggested several critical areas for theoretical analyses.

In designing _The Three Rivers School Simulation Game_ there was a conscious effort to incorporate some aspects of most of the critical structural elements, key characters, and pressing issues in contemporary urban schools and communities. The author is aware that the basic structure of the simulated urban school emerged from his own school experiences as both a student and a teacher. The author's research on the critical design elements focused upon the urban schools in Pittsburgh, Pennsylvania. It is assumed that the critical variables isolated in the simulation game design reflect some key elements from all schools and especially from schools in other urban centers throughout the United States. By involvement in four different urban education projects in Pittsburgh, the author was able to broaden his perceptions of the present situation. However many new sources were investigated to insure as realistic a simulation as possible of the key variables in the urban school and its social context. Sources of input included: administrators, counselors, teachers, and students from the Pittsburgh city schools, the textbook used in the course Social Foundations of Education, the students' compilation of key issues in education and society, and the students' written descriptions of actual teachers and students they had known. In order to add greater reality, accuracy, and validity to the simulation, a detailed study was made of one Pittsburgh school that seemed to illustrate most of the characteristics of the present urban school crisis.

In *The Three Rivers School Simulation Game* there are forty role descriptions including several students, teachers, administrators, and parents. Within the role descriptions there are emphases on the issues of racial conflict, the politics of change, curriculum reform, conflicting instructional strategies, and bussing. From both the simulation game design and empirical results of several groups' playing the simulation game there is evidence that *The Three Rivers School Simulation Game* enables most players to confront and make decisions about the following topics: power, authority, curriculum planning, teaching methods, programmed instruction, tests, grading, homework, tracking, evaluation of the school, Black studies, sex education, vocational education, athletics, discipline, dress codes, racial prejudice, safety in the schools, bussing, drugs, faculty governance, teacher strikes, and the hiring and dismissal of teachers.

There is significant empirical evidence that all of the general behavioral objectives for *The Three Rivers School Simulation Game* were well achieved. Players are given the following list of instructional objectives in the game manual:

1. To comprehend the realities of teaching in a particular school and community context.
2. To analyze the key problems of an urban school in crisis.
3. To synthesize one's personal feelings and understandings about learning theories, school models, and social forces of education.
4. To clarify one's attitudes toward self, others, and the teaching profession.
5. To develop comprehension and empathy for one's role and for the opposite point of view.
6. To develop an awareness of process.
7. To respond to the problems by choosing one's priorities and seeking solutions together with others.
8. To develop communication and negotiation skills.
9. To evaluate the various behaviors with which one has experimented.

Each player in Group One and Group Two compiled lists of what he or she learned by playing *The Three Rivers School Simulation Game*. Comparing lists of the top ten most frequently mentioned learnings by Group One and Group Two, both groups included the following six learnings:

1. The simulation game dealt with real problems and responses in typical school situations.
2. Change is a slow process.
3. Negotiation is an effective means of bringing about change
4. A variety of teaching methods are needed to motivate students.
5. Curriculum planning should include consideration of individual student's interests and needs.
6. People's opinions are more emotionally charged than they are supported by rational thinking.

Two of the most important instructional objectives for the simulation game were clarification of one's attitudes toward self and others and choosing one's value priorities. Playing <u>The Three Rivers School Simulation Game</u> and reflecting upon one's experiences during each session gave the players many opportunities to clarify their values. Such development, choosing, and acting upon values constitutes the highest levels of affective learning. There were numerous written and oral expressions of value learnings. To illustrate further the affective learnings during the instructional simulation game, responses to one of the debriefing exercises were analyzed according to Krathwohl, Bloom, and Masia's taxonomy of the affective domain. Group Two was asked at the end of the fourth session: "How much are you really like the person you are representing in your attitudes, prejudices, beliefs, feelings, convictions, and the things you say and do?" One quotation is cited for each level of valuing to illustrate the effectiveness of playing this simulation game for affective learning objectives:

3.1 Acceptance of a value

> I am pro-Blacks and pro-civil rights and consider myself non-prejudiced towards any race or creed. However, I am anti-militant and detest violence as a means to any end. Violence can only breed hatred and more violence and it will never result in any stable or meaningful change. Therefore I could not support any kind of militant student power movement, be it black or white.

3.2 Preference for a value

> I really do not differ from my role. I'm in favor of Black Power--meaning the power to acquire quality education and an equal standing in society. Yes, I shall become boisterous about the achievements of my people and of my pride in being Black.

3.3 Commitment

> The simulation game reinforced my dislike for rigid and pre-programmed learning in schools. I am a firm believer in the open classroom--it's more life oriented, more conducive to understanding and achieving educational goals that are personally set. It allows the pupil to establish some self-esteem and rapport with others.

4.1 Conceptualization of a value

> In some ways I guess I am more like my role than I at first thought. I would say that my two main interests in life are definitely not clothes and boys, but I am liberal in my attitudes toward sex and drugs.

4.2 Organization of a value system

> I find nothing similar in my own personality to my role. I do not live in a plush house, and I very rarely hold to the conservative line on any issue. The woman I play seems to be particularly closed minded; she is comfortable in her life style and she is uncomfortable with change. The issues she holds to be important would be at the bottom of my list of priorities. I feel that I am

fairly open to conflicting opinions and changes. I'd rather have a group of individuals than conformists.

5.1 Generalized set

I feel that my personal character differs from the person I am playing, but ideologically we are quite similar. I personally tend to be less provocative and more interested in discussion than argument. My role dictates an attempt to argue and criticize--that's not me. My open mindedness also offers a problem in that I can agree and at least sympathize with what is said; however my role has me contradicting and arguing with issues I can personally agree with.

5.2 Characterization

I am always searching, reaching out for what is right, establishing an idea about myself and my future, and wanting to help someone--to feel others lives and joys and sorrows, to grow into a new person by realizing that there are some things about the old me that I didn't like. Realization leads to communication and communication is where it's at.

In another debriefing instrument students from Group One were asked: "Are you motivated to play this simulation game? Why or why not?" Out of thirty-one responses there was unanimous affirmation of their motivation to get involved in the game, and several reasons were given for their interests. Most of the students saw this role play simulation game as an occasion to experiment with various behaviors, self-expressions, and relationships with different types of people. Some were primarily motivated by the study of the social issues of the urban crisis; others sought to explore the possibilities of change. Two students were enthused about their self-chosen roles because they were seriously considering switching their majors toward these careers. Several students mentioned that the simulation game was a new and enjoyable experience of learning.

To expand on the evaluation of the learning effects of playing The Three Rivers School Simulation Game, a pre-test and a post-test were administered to Group Two. It is assumed that significant changes in students' responses from the pre-test to the post-test indicate learning effects caused by the experience of playing the simulation game. The test instrument is reproduced in Table One.

TABLE ONE
PRE-TEST AND POST-TEST ADMINISTERED
TO GROUP TWO

SELF-STUDY ATTITUDE STUDY	Yes	No
1. Do you usually feel comfortable with those in authority over you?		
2. Are you in favor of bussing?		
3. Are you now adequately prepared to teach?		

	Yes	No
4. Are you confident of your ability as an agent of change?		
5. Do you understand the Black's discontent?		
6. Do you think that compromise is the best solution to conflict?		
7. Is it a hopeless struggle to change a strong, centralized power situation?		
8. Would you like to teach in an urban school?		
9. Are you a good decision-maker?		
10. Are you prepared to handle a school crisis?		
11. Do you think that school is a pleasant place to work?		
12. Do typical faculty care about the personal needs of the student?		
13. Do you see yourself as a good leader?		
14. Do you favor open classroom?		
15. Are radical actions the best way to change a situation?		
16. Do you approve of affirmative action for Blacks?		
17. Are schools democratic?		
18. Do you think that meetings are a good way to resolve problems?		
19. Are discipline and order a pre-requisite for good education?		
20. Do you favor programmed instruction?		
21. Do you approve of hall guards?		
22. Are you sympathetic with Black militants' demands?		
23. Is change easy to bring about?		
24. Do the schools adequately prepare students who are not going to college?		
25. Do faculty care about each other?		
26. Do you have some racial prejudice?		
27. Is there considerable chaos in typical urban schools?		
28. Does change usually happen quickly?		
29. Are you a good negotiator?		
30. Does the faculty control most of the power in a school?		
31. Are most students apathetic?		
32. Do faculty care about administrators?		
33. Do students have much power without the support of some faculty?		
34. Should every school have a Black Studies program?		

	Yes	No
35. Does the administration control most of the power in a school?		
36. Is a teacher autonomous in his or her teaching?		
37. Are school boards effective?		
38. Do administrators care about faculty?		
39. Should sex education be taught in a school?		
40. Do you know most of your classmates in this class?		
41. Is your role very different from yourself?		
42. Do you feel that you can get into the facts and feelings of your role?		
43. Do the roles represent typical characters in a school and community?		

Name______________________________Role______________________

The identical test was administered for both the pre-test and the post-test on the same day of the week and during the same class period. The pre-test was administered prior to any discussion of the simulation game, and the test was taken at the beginning of the period in which warm-up session one was played. Immediately at the end of the playing of the last session of the simulation game and prior to any debriefing discussion for the last session, the post-test was taken. Because of some absentees for one of the tests or incomplete responses on some tests, there are total pre-test and post-tests for only twenty-four students out of a potential of thirty-eight students. However there is sufficient and proportionate representation of roles among the test respondents, for 60 per cent of the Students, 55 per cent of the Teachers, 64 per cent of the Administrators, and 83 per cent of the Parents took both the pre-test and post-test.

The following tables summarize the results of the pre-test and post-test. Table Two indicates the changes in response on each question, and Table Three represents a rank ordering of the total changes on each question.

TABLE TWO
RESULTS OF THE PRE-TEST AND POST-TEST ADMINISTERED TO GROUP TWO: SUMMARY OF CHANGES IN RESPONSE ON EACH QUESTION

Question	Yes On Both Tests	No On Both Tests	Positive Change	Negative Change	Total Change	Male Change	Female Change
1.	14	5	3	2	5	2	3
2.	7	13	2	2	4	1	3
3.	6	11	5	2	7	1	6

TABLE TWO-Continued

Question	Yes On Both Tests	No On Both Tests	Positive Change	Negative Change	Total Change	Male Change	Female Change
4.	12	7	3	2	5	2	3
5.	15	3	5	1	6	1	5
6.	14	4	5	1	6	3	3
7.	1	20	3	0	3	1	2
8.	17	3	1	3	4	1	3
9.	18	3	2	1	3	2	1
10.	10	11	2	1	3	1	2
11.	15	3	3	3	6	2	4
12.	1	18	5	0	5	4	1
13.	18	4	1	1	2	1	1
14.	21	2	0	1	1	1	0
15.	0	19	3	2	5	1	4
16.	2	21	0	1	1	0	1
17.	1	23	0	0	0	0	0
18.	12	4	6	2	8	4	4
19.	5	14	3	2	5	1	4
20.	3	17	1	3	4	1	3
21.	2	20	1	1	2	1	1
22.	12	10	2	0	2	0	2
23.	0	24	0	0	0	0	0
24.	1	22	1	0	1	1	0
25.	4	12	7	1	8	4	4
26.	19	4	0	1	1	1	0
27.	20	1	2	1	3	3	0
28.	0	24	0	0	0	0	0
29.	21	1	1	1	2	1	1
30.	8	9	3	4	7	2	5
31.	16	3	3	2	5	2	3
32.	6	7	5	6	11	3	8
33.	0	22	0	2	2	1	1
34.	18	2	3	1	4	1	3
35.	20	1	3	0	3	2	1
36.	1	14	3	6	9	4	5
37.	3	12	8	1	9	1	8
38.	6	12	3	3	6	2	4
39.	24	0	0	0	0	0	0
40.	13	2	9	0	9	7	2
41.	16	4	3	1	4	2	2
42.	19	1	2	2	4	1	3
43.	22	0	2	0	2	1	1

TABLE THREE
RESULTS OF THE PRE-TEST AND POST-TEST ADMINISTERED TO GROUP TWO: RANK ORDERING OF THE TOTAL CHANGES ON EACH QUESTION--SUMMARY FREQUENCY DISTRIBUTION

Number of Changes	Question Numbers
11	32
9	36,37,40
8	18,25
7	3,30
6	5,6,11,38
5	1,4,12,15,19,31
4	2,8,20,34,41,42
3	7,9,10,27,35
2	13,21,22,29,33,43
1	14,16,24,26
0	17,23,28,39

within a range of 11 changes, the median is 4.25 and the mean is 4.12 per question. This change in learnings on each question by the tested population of 24 students represents a mean of 17 per cent.

Further consideration of the total changes by item suggests that The Three Rivers School Simulation Game gave the students from Group Two a new experience of the realities of teaching in a school. The modal question, number 32, and a total of 80 per cent of the upper quartile of questions in Table Three, refer to topics about the teaching profession that a prospective teacher would grow to understand especially through first-hand experiences. The high number of changes on items in the post-test dealing with teaching, school, and education indicate that the simulation game promoted achievement of its instructional objectives: to comprehend the realities of teaching in a particular school and community context; to analyze the key problems of an urban school in crisis; to synthesize one's personal feelings and understanding about learning theories, school models, and social forces of education; and to clarify one's attitude toward the teaching profession.

There is also significant evidence from the test results to support achievement of the simulation game's instructional objectives dealing with communication and negotiation skills and the processes of change. Seven changes on question 30 concerning the faculty's power in a school reveal the players' grappling with the various problems of authority and conflict in a school, and seven changes on question 4, which asked about the player's ability as a change agent, suggest that the players had new experiences in issue resolvement. The changes on items 5, 15, and 18 show that more students would choose dialog, meetings, and compromises rather than radical actions to change a situation; and these learning effects indicate some positive achievement of the simulation's instructional objective to clarify one's priorities and to seek solutions together with others. In regard to accomplishing the objective to develop empathy for the opposite point of view, there were five positive changes on question five concerning understanding of the Blacks' discontent.

Nine positive changes on question 40 concerning whether an individual knows most of his classmates constitutes a 38 per cent increase in interpersonal communication, knowledge, and group cohesiveness. Many students indicated in their journals that the simulation game was an enjoyable experience of discovery learning among their peers.

The action research has indicated several critical areas for theoretical analyses. What are the effects of the experiential and behavioral qualities of this teaching method? What are the sources of motivation and enthusiasm to play the role play simulation? What are the unique teaching and learning effects of role playing and negotiation? What are some of the critical sources of growth in the affective domain by playing the role play simulation game? Results of detailed theoretical analyses by the author are hereby summarized.

Analysis of the uniqueness of role play simulation games indicates that they are a discovery method of teaching providing student-directed inquiry into and behavioral experiences of operational models of real world systems. This method unites thought, feeling, and action in a learner's transaction with an environment. Active involvement and manipulation of simulated variables produces instant feedback, leading to reflection and the reconstruction of one's experience.

Role play simulation games are intrinsically motivating because of several characteristics of this teaching method. Active involvement and direct control over the elements of an environment give rise to intrinsic reward and competence awareness. Games are goal oriented, and players incidentally learn content that is directly and logically related to the achievement of the goals of a game. The competitive nature of role play simulation games heightens desire for success, while cooperation emphasizes lively communication and peer learning. Motivation also derives from the unity of thought, feeling, and action in playing role play simulation games.

The method of role play simulation games can enable significant self-study of attitudes, growth in self concept, and skill development in interpersonal communication. This educational method draws special attention to the emotional controls of behavior. Role playing promotes experiences and internalizations of several social roles and role expectations, and players of simulation games can grow in awareness of self through communication with others. Difficulties in role involvement and inter-role conflicts tend to give rise to value clarification. A student can express his uniqueness through decision choices among pressure groups and strategic options and also by becoming a relational thou for others.

In conclusion it seems appropriate to offer suggestions for future research in areas related to this work. In regard to The Three Rivers School Simulation Game, more fundamental research is needed to validate further its effectiveness in promoting a variety of different learnings. A long-term longitudinal study with control groups could determine the effectiveness of its use in several competency areas of teacher education. More fundamental research is also needed on the comparative effects of behavior-based and experiential teaching methods versus expository teaching methods in teacher education programs. The method of role play simulation games also offers a fertile field of inquiry for philosophy of education. Further description and analyses of the processes and essential elements of learning in simulation games can not only enrich the educational theory of simulation games but also may provide unique discoveries about the nature of education.

DESIGN, DEVELOPMENT, AND VALIDATION OF ANTICIPATION GAMES[1]

Melvyn I. Semmel and Sivasailam Thiagarajan
Center for Innovation in Teaching the Handicapped
Indiana Univerisity, Bloomington, Indiana 47401

Anticipation games require players to predict the behaviors of different subgroups of the target population in different situations. The players' success in the game is directly related to the accuracy of his anticipations in comparison to empirically established norms. At the Center for Innovation in Teaching the Handicapped, different versions of the anticipation games have been produced to help teachers better understand handicapped children in their classrooms. The design and development of these games involve the three stages of analyzing people and situations, establishing a normative data base, and selecting suitable game formats. A basic study on the anticipation of the responses of different types of children by college students indicates that sex, age, experience, and education are related to the accuracy of anticipation. Three studies on the learning and transfer effects of playing anticipation games suggest that while teacher-players improve on their accuracy of anticipations within the context of the game, transfer of this skill to their own classrooms is not at a significant level.

ANTICIPATION AND UNDERSTANDING

The psychologist, the lawyer, the salesclerk, or any other professional has to understand his clientele in order to efficiently fulfill his role. Understanding, however, is a vague term and it may be partly operationalized through the notion of anticipation. The degree to which a person is able to anticipate accurately what is going to happen is a valid indicator of his understanding of people and events. There is ample evidence in the literature to indicate that individuals differ in the quality of their anticipations and that there is generally a positive correlation between the accuracy of anticipation and efficiency of performance. Anticipatory skill is of special importance to the teacher who has the duty of keeping his/her learners inside the optimal area between frustrating challenge and boring simplicity. The teacher of the handicapped needs to anticipate all the more in order to protect his/her children from continuously experiencing failure.

Kelly's (1955) development of a cognitive dissonance model of personality and DeCharm's (1968) notion of the attribution process suggest how a

---

[1]This developmental activity was supported by grant #OEG 9-242178-4149-032 from the U. S. Office of Education, Bureau of Education for the Handicapped to the Center for Innovation in Teaching the Handicapped. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

person's understanding constantly undergoes modification through anticipation and reality testing: On the basis of his past experiences a person derives a set of hypotheses, generalizations, and principles which constitute his understanding. From this base he anticipates the moves of others. If the ensuing event coincides with and confirms his/her anticipation, the person's understanding is strengthened; if it contradicts the anticipation, the basic hypotheses are suitably modified to expand his/her understanding.

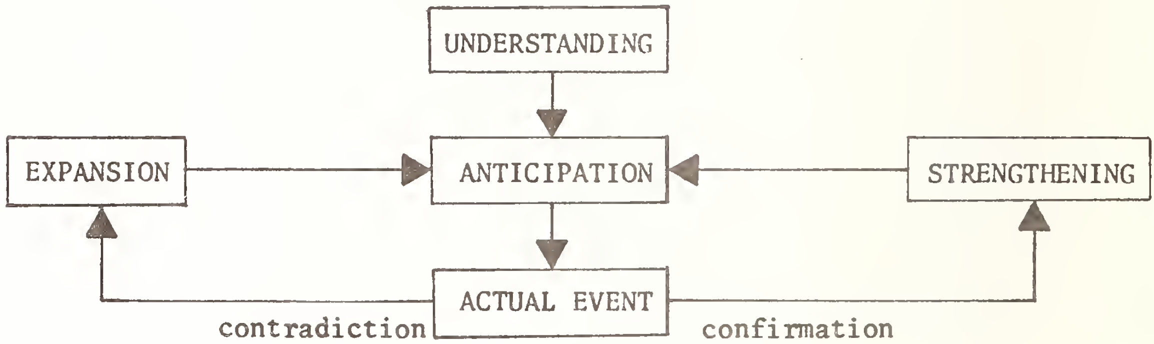


Figure 1. Relationship between understanding and anticipation.

An example by Baum (1973) illustrates how this process operates in the case of a teacher's understanding of retarded children in his/her classroom. This teacher spends the first day of school having the students tell about their summer experiences. One student speaks with above-average verbal fluency while another has major problems in communication. This experience provides a base of understanding for the teacher. On the second day of school, the teacher asks the students to write their names, addresses, and parents' first names. The teacher anticipates that the child who demonstrated superior verbal abilities on the previous day will perform well and the other child poorly on this assignment. In evaluating the written assignments, the teacher notes that his anticipation about the verbally adept student is wrong: His writing is below average, just as poor as the other child's. Lack of confirmation of the anticipation results in the teacher's better understanding of the relationship between oral and written expression.

<u>To Improve Understanding</u>

This model suggests that understanding is expanded and strengthened through making repeated anticipations and comparing them with actual outcomes. Obviously, experience is a good teacher and on-the-job teacher training has appealing face validity. However, some limitations become apparent: The teacher being trained on the job may have to wait a long time before he/she is able to experience the desired variety of outcomes. He/she may be under pressure to cope with the current reality and may not have the time to anticipate. The time lag between anticipation and the actual outcome may be so great that the effects of the feedback are minimal.

The traditional approach to providing the teacher with an understanding of children is through introductory courses. In lectures and textbooks, the teacher trainee is presented various facts about individual and group differences among learners. This approach has been notoriously inefficient and, in most cases, textbook principles have very little relevance to the realities of the classroom. Principles taught in these courses are of questionable validity. Further, this approach deprives the teacher of any opportunity for learning through anticipating.

An alternative approach to providing knowledge and understanding to teachers in training is becoming popular. This involves the use of protocol materials (Smith, 1969) which are recordings (usually on audio- or videotape) of classroom interactions to exemplify educationally relevant concepts and generalizations. Through a study of these transcripts and reproductions of real-life behavior, the teacher trainee acquires a deeper understanding of such behavior. However, the actual use of protocols by themselves has turned out to be inefficient because the trainee becomes a passive receiver of information. He/she is not required to anticipate actively and check actual events. Because of the nature of the concepts they portray, most protocols are considered extremely dull.

At the Center for Innovation in Teaching the Handicapped, we have developed a series of inexpensive card-and-board games (Semmel, 1972) which improve upon the advantages of using protocols and on-the-job training. Specific details of one of the games, THINK STRAIGHT, are given in the appendix. The games require the player to anticipate repeatedly the responses of different types of children to different task requirements. Players receive immediate feedback based on empirical data. The winner for each round of the game is the player whose anticipation is the closest to the actual outcomes. The greatest instructional strength of the game lies in the fact that the success of the player is judged not by expert opinion, nor by particular generalizations about children, but by actual normative data. Thus, feedback to the player is as realistic as the feedback to the classroom teacher. By providing a large number of anticipation-feedback cycles in a limited period of time, the game adds systematic efficiency to the reality of the classroom.

DESIGN AND DEVELOPMENT OF ANTICIPATION GAMES

As we indicated earlier, a number of different anticipation games have been produced at the Center for Innovation in Teaching the Handicapped. In the process, we have also evolved a generalized procedure for the design and development of such games. This procedure involves three stages: analyzing people and situations; collecting normative data on the behavior of different people in these situations; and, choosing a suitable game format to incorporate these norms.

Analysis

Although the Center's major interest is in the training of teachers of the handicapped, anticipation games are usable in any situation where the training objective calls for an understanding of people and their behavior. There are two particular instructional situations where these games are especially effective: One is where previous experience and prejudices interfere with objective understanding and the second is where blind faith in glowing generalities is likely to result in disillusionment.

Anticipation involves a person and a situation. In this analysis phase, the target group of people is identified and categorized into subgroups on the basis of such variables as sex, race, age, education, or any other relevant variable. Similarly, the situations in which the behavior of these people is to be anticipated are also carefully analyzed and categorized.

Collecting Normative Data

The heart of the anticipation game is a number of situations representative of those in real life where the target population's behaviors are to be anticipated. In the sample game described in the appendix, we are interested in a test-like situation. This requires the creation of a set of cards with test items from different subject-matter areas and at different levels of difficulty. Once a suitable set of situations is created (i.e., test items), the next step is to collect normative data on the actual behavior of different subgroups of the target population. This process is very similar to the standardization of a test. It involves locating appropriate groups, choosing random samples, having the subjects respond in standard situations, collecting data on their behavior, and reducing them to convenient norms. Although time consuming and expensive, this process is the most important one in the development of the anticipation game since it guarantees external validity. Some short-cut procedures may be used to speed up the process or at least provide the first approximation of norms:

1. Using existing data. Tables found in research literature are too condensed to be of use in the development of anticipation games. However, original investigators may be contacted for their raw data. Such data, obtained during the standardization of tests in various subject-matter areas or from surveys and interviews, may be used as the base for anticipation games. This approach was used in the development of the game described in the appendix.

2. Student-collected data. Students may take part in the process of collecting data with the usual result of increased learning from the game they helped to develop. By requiring individuals or small groups of students enrolled in the course to collect data on a standardized form from various subsections of the target population, a large data pool is generated.

3. Data on individual subjects. In appropriate situations, the anticipation game may concentrate on individual subjects instead of representative groups. Although these norms may be of limited generalizability, developing

a game around individual subjects may prove to be of didactic value in emphasizing individual differences and the variability of individual behavior.

4. Artificial data. Suitable "data" may also be generated on the basis of a theoretical model or a conceptual framework. In the development of certain games we have programmed a computer to print out normative data within given parameters and with random variability. Unless the model used as the base has empirical validity, such data may oversimplify reality and mislead the student.

Choosing a Game Format

Normative data may be incorporated in a wide variety of different board-and-card game formats. The two dimensions of people and situations suggest matrix game formats. The classification of either people or situations indicates rummy-type games. We have experimented with over two dozen varieties and found each suitable to achieve a slightly different purpose. A good anticipation game should have all the features of any good game: simple and fair rules; optimum amount of chance; continuous participation by all players; and, fast pace. In addition, to be effective in training, these games should require players to make repeated anticipations, provide them with scores which are inversely related to the differences between actual and estimated values.

EVALUATION

The effects of anticipation games have been evaluated in a number of different studies at the Center for Innovation in Teaching the Handicapped. The results of four studies are summarized below:

Study I

Semmel, Garret, D. Semmel, & Wilcove (1973) undertook this study to determine how accurately different groups of college students anticipate educable mentally retarded (EMR) and non-retarded children's responses to a set of questions. Although no game was involved in this study, its findings about individual variations in anticipation are of interest to the designer and the user of the game. The study was undertaken in two phases: The first phase involved collecting a normative data base; the second, investigating anticipation moves of college students.

Phase I

Subjects. Sixty-five boys between the ages of 11 and 14 with IQs ranging from 60 to 89 were used as the EMR group. Sixty-six children (50 boys, 16 girls) between the ages of 10 and 14 with IQs ranging from 90 to 116 were used as the non-retarded group.

Materials. Twenty-four test questions, each on an individual card, were used in this phase.

Procedure. The test was administered orally to each individual child using a standardized procedure. The children were assured that this was not a regular classroom test. Between administrations, question cards were shuffled to prevent any serial order effects.

Results. Free responses of the children were recorded and the most frequent responses were identified. In 16 out of 24 questions, the most frequent responses given by both the non-retarded and EMR groups were identical. Differential responding was the greatest with questions which required imaginative free-association responses, intermediate with problem-solving questions with more than one correct solution, and the least with problem-solving questions with only one correct solution.

Phase II

Subjects. Seventy-seven men and 213 women from courses in undergraduate educational psychology, undergraduate psychology, undergraduate special education, and graduate special education at Indiana University were involved in this study.

Materials. A questionnaire, consisting of the 24 questions that were used to collect the normative data base, was prepared. The 10 most frequent responses of children were listed below each question and the subjects were instructed to indicate which response would be most commonly given by each group of children.

Procedure. The questionnaire was presented during a regular class session. Demographic information was also collected from each subject.

Results. The range of correctly anticipated responses of EMR children was 0-15; the range for non-retarded children was 5-18. Six subject variables--sex, age, academic major, semester hours in special education courses, experience with EMR children, and the course in which the subject was currently enrolled--were analyzed individually in a two-way fixed analysis of variance design with repeated measures over the effects of the two samples of children (EMR and non-retarded). The results of these analyses and Scheffe's post-hoc comparisons are given in Table 1.

Table 1. Effects of Subject Variable on Anticipation

Subject Variable	Main effect of variable	Interaction
Sex	Significant ($p<.05$). Women had higher scores (mean = 9.5, s.d.= 2.6) than men (mean = 8.9, s.d., = 2.9).	Significant interaction between sex and type of children ($p<.05$). Women scored significantly better than men in anticipating the responses of EMR children.
Age (18-19, 20-21, 22-23, and 24+)	Significant ($p<.05$). 24+ group scored significantly better than 22-23 group ($p<.05$).	--
Academic major (Special education, elementary education, secondary education, psychology and other)	Significant ($p<.001$). Special education majors predicted more accurately than psychology and other majors.	--
Semester hours in special education (0, 1-3, 4-6, 7-9, 10-12, and 13+)	Significant ($p<.01$). Post-hoc analyses showed no significant differences although the 13+ group had the greatest mean score while both the 0 and 7-9 groups had the lowest scores.	--
Experience with EMR children (None, little, moderate, and extensive)	Significant ($p<.01$). Subjects with extensive experience anticipated children's responses better than those with none ($p<.01$) or little ($p<.05$).	Significant interaction between experience and type of children ($p<.05$). Subjects with extensive experience anticipated EMR responses better than those with none ($p<.05$).
Current course enrollment (undergraduate special education, undergraduate educational psychology, undergraduate psychology, graduate special education)	Significant ($p<.05$). Post-hoc analyses showed no significant differences although undergraduate and graduate special education courses had the highest scores.	Significant interaction between type of course and type of children ($p<.05$).

Study II

This pilot study was undertaken by Semmel and Sivasailam (1971) during the formative evaluation of the anticipation game TRUE GRID (Semmel, 1972). The object of the study was to investigate the effects of repeated playing of the game.

Subject. A single, foreign born, 20-year-old, female subject was used in this study. The subject did not have any previous knowledge of, or experience in, the education of handicapped children.

Materials. TRUE GRID is a two-person anticipation game which uses a 4 x 3 grid. Moves in the game involve anticipating the percentage of three different types of children (normal, 66-80 IQ group, and 50-65 IQ group) at three different age levels (9, 11, and 13) who responded to questions from four different subject-matter areas (arithmetic, language, reading, and work-study). The scoring system of the game discourages players from concentrating on a specific subject-matter area or a specific type of child. More than 150 questions are used in the game to prevent any practice effect. Normative data on these questions came from an earlier study (Meyen & Hieronumus, 1970) which surveyed 1,405 children.

Procedure. The experimental subject played a total of 20 games, each with a different opponent, over a period of three weeks. Anticipations during each round of the game were recorded on response sheets which provided a cumulative record for later analysis. At the end of each game, the subject was debriefed and asked to list any new rules of strategy she discovered during the play of the game.

Results. Each anticipated percentage was compared to the actual percentage from the norms and a deviation score was computed. These deviation scores became smaller as a function of the number of rounds of the game played, indicating increased accuracy in anticipation. The results revealed that the rate of learning to anticipate was most rapid for the highest (normal) and the lowest (50-65 IQ) groups respectively. The rate of learning to anticipate for the intermediate (66-80 IQ) group was the slowest. There was also a positive relationship between the rate of learning and the age of pupils for whom predictions were made.

Of the 84 strategy statements listed by the subject during the debriefing sessions, 27 dealt with game moves (e.g., "Begin with a corner cell and work toward the center."). Among the remaining were developmental generalizations (e.g., "There is very little difference between 11- and 13-year-old normal children in their responses to these language questions."), principles relating to IQ levels and performance (e.g., "Retarded children are harder to predict. They are less stable."), insights into subject-matter areas (e.g., "Arithmetic problems which involve fractions are the toughest for all children."), and test characteristics (e.g., "If a child does not know the answer he is more likely to choose the first or last alternative than any of the middle ones."). Many of these principles discovered by the subject are comparable to those found in introductory textbooks on methods of teaching retarded children.

Study III

Having informally established that the player does learn to make more accurate predictions as a result of playing TRUE GRID, another pilot study (Zimmerman, 1973) was undertaken to investigate if this skill transfers to the anticipation of student behavior in the teacher-player's classroom.

Subjects. Nine intern teachers from the University of Louisville were involved in this study. They were randomly assigned to experimental (n=5) and control (n=4) groups.

Materials. The TRUE GRID game was again used in this study. In addition, a 24-item test which contained questions similar to the ones used in the game was also constructed. The questions were from the areas of vocabulary, spelling, and arithmetic. The test was available in two different forms: One was for direct administration to retarded children and the other, a questionnaire for teachers' predictions.

Procedure. Five interns played TRUE GRID while the other four played an unrelated game in separate classrooms for a period of two hours. The groups were brought back together and given the 24-item questionnaire which required them to predict the percentages of children in their classrooms who would correctly answer each question. Each subject took back with him copies of the test which contained the same 24 questions and administered it to the children in his classroom using a standardized procedure. Children's responses were returned directly to the investigator for analysis.

Results. Three 2 x 3 (treatments x content areas) analyses of variance were performed on actual student performance (A), teacher predictions (B), and accuracy of anticipation (A - B). There were no significant differences in actual student performances. Teacher predictions of arithmetic scores differed significantly ($p < .05$) between control and experimental groups. There was a significant difference in the accuracy of anticipation in only one of the three subject-matter areas. The results indicate that while there was a trend toward transfer of anticipation skills from the game to the behavior of children in the teacher's own classroom, this was not conclusive.

Study IV

The lack of more impressive transfer of anticipation skills to the classroom in the previous study could have been partly due to the normative data base of the game differing from that of local students. Baum (1973) created a normative data base from local students to study the learning and transfer from a game incorporating that data. In the most comprehensive study of anticipation games undertaken to date, he also attempted to cross validate the findings from earlier pilot studies.

Phase I: Collecting a normative data base

Subjects. Two hundred and ninety students in special classes for the educable mentally retarded (EMR) in five junior high and three senior high public schools in Cincinnati, Ohio were used as subjects. One hundred and sixty six of the sample were male and 124, female. Their ages ranged between 13 and 19, their IQs, between 50 and 80.

Materials. A 70-item multiple-choice test based on the Persisting Life Problem areas identified in the Cincinnati curriculum guide for the EMR was developed by the investigator.

Procedure. The test was administered to students in classrooms in the absence of their teachers. The students were told that none of their teacher would see their answers and their performance would not affect their grades. The investigator presented each question orally and repeated it if requested by any student. Demographic data were obtained from school records.

Results. Students were sorted into four groups according to age levels (younger--13-15; older--16-19) and IQ levels (lower--50-64; higher 65-80). Test results were analyzed and a frequency distribution in percentages was obtained for responses by each of the four groups of students.

Phase II: Treatment and assessment of anticipation skills

Subjects. Thirty teachers (whose students had been involved in Phase I) were subjects in this phase. Eighteen teachers were male and twelve, female. All had training and experience in teaching EMR children. The teachers were randomly assigned, within their schools, to either an experimental or a control condition.

Materials. The normative data collected in Phase I was incorporated into a two-person anticipation game called BATTLE CHIPS. This game required players to predict percentages for each of the four alternatives for each multiple-choice question. These predictions were recorded in specially designed response sheets for later analysis.

Procedure. Teachers were given a questionnaire for obtaining demographic data. The experimental subjects played BATTLE CHIPS while the control subjects played a two-person commercial game called PERCEPTION. During the first session subjects played games from 25 to 45 minutes, depending upon the free time available. Question cards used in this session were removed before the next one began. This session terminated when each player complete 30 rounds of the game.

Results. A deviation score for each anticipation given by the experimental players was calculated by subtracting the predicted percentages from the actual values. The types of analyses and the results are summarized in Table 2.

Variables	Analysis	Result
Effect of playing BATTLE CHIPS on accuracy of anticipation	Serial analysis of variance (7 dyads x 3 sets of ten rounds of the game)	Accuracy increased significantly ($p < .05$) as a function of number of rounds played.
Relationship between teacher characteristics (age, sex, type of class taught, educational level, teaching experience, and impressions of the game) and accuracy of anticipation	Correlational analyses	No significant relationships.
Relationship between teacher characteristics and overestimates in anticipation.	Correlational analyses	No significant relationships.
Relationship between student characteristics (age and IQ level) and accuracy of anticipation.	Analysis of variance	No significant effects.

Table 2. Effects of playing BATTLE CHIPS

Phase III: Transfer of anticipation skills

Subjects. Same as those in the previous phase.

Materials. A 20-item criterion test was developed from the earlier 70-item test on the basis of a factor analysis which identified the five factors of (a) map reading and arithmetic, (b) practical-functional, (c) spelling, (d) synonyms, and (e) number usage. Items which had rotated factor loadings over .40 and which represented several areas of the curriculum were included in this criterion test.

Procedure. The names of five high-IQ-level and five low-IQ-level children were selected randomly from the total homeroom class lists of each teacher. These names were randomly listed at the top of the criterion test. Each teacher was required to predict which multiple-choice alternative each of these children would choose for each test item.

Results. Predictions were scored as correct if the teacher selected the same alternative the particular student had chosen earlier. A comparison of accuracy of anticipation between experimental and control subjects was accomplished through a one-way analysis of variance which did not yield any significant difference. A number of other hypotheses were also tested and the results of some of these are summarized in Table 3.

Variables	Analysis	Result
Relationship between students' IQ levels and accuracy of anticipation	2 x 2 Analysis of variance	Significant ($p < .01$). Performance of high-IQ EMRs were more accurately anticipated.
Relationship between factor analytic component of questions and accuracy of anticipation.	2 x 5 Analysis of variance and planned comparison	Significant ($p < .05$).
Relationship between teachers' assessment of the general ability levels of children and accuracy of anticipation.	Correlational analysis	Significant ($p < .01$) positive correlation.

Table 3. Transfer effects of playing BATTLE CHIPS

FUTURE ACTIVITIES

The findings of the Semmel et al (1973) study demonstrate that anticipation is a complex phenomenon warranting further investigation. While we study individual differences among anticipators, our game development activities continue to expand. From the cognitive verbal responses of children in test-like situations, we are moving into affective reactions of different children (e.g., emotionally disturbed) to different classroom climates presented through videotape segments. In the evaluation of anticipation games, we are currently expecting three types of validation: internal validation which measures the extent to which players learn anticipation skills within the context of the game; transfer validation which measures the transfer of these skills to relevant classroom behavior; and payoff validation which measures the effects of these increased skills on the motivation and learning of the handicapped child.

References

Baum, R. B. The efficacy of an anticipation game in increasing teachers' understandings of educable mentally retarded children. Center for Innovation in Teaching the Handicapped, Indiana University, 1973.

DeCharms, R. Personal causation: The internal affective determinants of behavior. New York: Academic Press, 1968.

Kelly, G. A. The psychology of personal constructs. New York: Norton, 1955.

Meyen, E. L., & Hieronumus, A. N. The age placement of academic skills in curriculum for the EMR. Exceptional Children, 1970, 36(5), 333-339.

Semmel, M. I. Anticipation games (consisting of three instructional games: True Grid, Over Easy, and Twenty-five, with variations). Center for Innovation in Teaching the Handicapped, Indiana University, Spring, 1972.

Semmel, M. I., Garrett, C. S., Semmel, D., & Wilcove, G. Anticipation of cognitive behavior of mentally retarded and normal children. Technical report. Center for Innovation in Teaching the Handicapped, Indiana University, 1973.

Semmel, M. I., & Sivasailam, C. The effect of playing anticipation games on increasing the anticipation skill: A pilot study. Center for Innovation in Teaching the Handicapped, Indiana University, 1971.

Smith, B. O. Teachers for the real world. Washington, D. C.: The American Association of Colleges for Teacher Education, 1969.

Zimmerman, W. Effects of the anticipation game on intern teachers' predictions of their retarded students' performance. Pilot study, Center for Innovation in Teaching the Handicapped, Indiana University, May, 1973.

APPENDIX

THINK STRAIGHT

Equipment

1. Question cards. There are question cards of three different colors representing the three subject-matter areas of reading, language, and arithmetic. On one side of the card there is a multiple-choice question. The other side contains a table of percentages of children (grouped by age and IQ level) responding correctly to the question.

129

Arithmetic Skills: Concepts

Choose the best answer.

Jack has 12 marbles and gave 25% of them to Ralph. How many marbles did he give to Ralph?

1) 3
2) 6
3) 9
4) 10

129

Age	9	10	11	12	13	14
EMR Group	14	11	13	15	12	16
50-65 IQ Group	15	14	12	24	11	16
66-80 IQ Group	13	10	14	13	12	16
Normal Group	19	41	58	71	80	71

Figure 2. A sample question card for the THINK STRAIGHT game

2. Board. The playing board is a 3 x 3 grid in which the rows represent normal, 50-65 IQ group, and 66-80 IQ group; the columns represent the three subject-matter areas of reading, language, and arithmetic.

3. Poker chips of two different colors.

Players

This game may be played by two players or two teams of players. Each player or team is identified by poker chips of the same color.

Object

The object of the game is to get three poker chips of the same color in a straight line (vertical, horizontal or diagonal) on the board just as in tic-tac- toe. Only one chip may occupy any given square.

Play

1. Both players agree beforehand as to a specific age to be used in the game. One of the players asks for a question for a given type of children in a given curricular area (e.g., "I want a work-study question for a normal child."). The other player removes a random card from the deck containing questions on the specified area.

2. The first player writes down a percentage prediction. The other player may challenge this by writing down a different figure.

3. The card is turned over to get the actual percentage. Whichever player has a percentage prediction closest to the actual percentage wins the round and places a chip of his color on the appropriate cell. If the first player was not challenged, he wins if his prediction is within 5 percentage points of the actual value.

4. Play continues with the other player specifying the cell he wants to play for. A player wins if he is able to get three of his chips in a straight line.

USING SIMULATION TO IMPLEMENT TABA'S COGNITIVE THEORY*

Richard A. Schusler, Ph.D.
Kansas University
Lawrence, Kansas 66044

The Teaching Condition Today

In the present day scheme of education, there is a need to implement higher cognitive skills of thinking with children. For the most part teachers teach the content of the curriculum at a descriptive level. It is easy for all of us to recall how day after day in the classroom we read word after word, did problem after problem, spelled word after word, memorized data after data and wrote answer after answer from the book. Teaching of this type is narrow and restrictive. It does not demand much more than the right answer and makes interaction with the data a risk taking decision. It is strange that today, in this world of fantastic banks of information and stores of knowledge, there is appearing little evidence of decreased emphasis upon recall and overwhelming mechanics in the classroom.

As one visits the elementary classrooms of today, one sees little change in the level of teaching. There is plenty of change in techniques, both from the standpoint of the teacher himself and the materials he uses. Classrooms are full of manufactured materials for rewarding pupils for giving right answers from recall. Tokens, reading machines, computer assisters and tapes all are geared for this type learning. Prescription teaching, individualized instruction (in many cases) and programmed indexed material all promote basically recall learning.

Education is currently in one of its pendulum swings. The thrust is now writing behavioral objectives for most learning tasks in the classroom. Through this mode of teaching a fact emerges. Teachers mainly think of teaching at the recall level and they write their behavioral objectives at the recall level. Recall so many facts, do so many tasks are evaluative measures used at this level of learning.

As long as the theory exists that the human mind is basically an empty vessel only and knowledge is like liquid that you use to fill the vessel with no commitment as to whether it is useful or what function it performs, then the students we turn out will be the same as now. Is this fair to the child? Could he learn to think at a higher cognitive level? The answer is no, it is not fair because the child can be taught to think in more complex terms and at higher cognitive levels. Thinking is a mind organizing process and it can be learned just as making a cake or solving a mathematical formula can be.

---

*A paper delivered at the International Simulation and Gaming Association Conference, Washington, D.C., September, 1973.

Benjamin Bloom[1] has neatly categorized several stages of cognitive development into knowledge, comprehension, interpretation, extrapolation, application, analysis, synthesis and evaluation. These stages represent a hierarchical sequence of learning and clearly point out to the teacher what is desirable as educational outcomes. They also point to the fact that these educational outcomes are not being accomplished. The graduates of our school systems today are for the most part just what we have taught them to be: descriptionists.

As a crux of the condition of the society at large, there has to be a massive reconstitution in educational methodology in our schools today. We simply have to make the connection in our minds that what we have done in school is related to what people are when they leave school. While Bloom gives us the educational objectives, he does little with the sequential processes.

The process is the thing of learning. Two interesting research findings shed some light on this. Flanders, an exponent of interaction analysis, has found that teachers talk over seventy percent of the time. This time is mainly spent in imparting content. Much less time is spent in using pupils statements, encouraging remarks and other rewards. Questioning is done at the recall level most. Schusler has found, using drawings of normative gestures, positions and stances of teachers and asking pupils to ascribe statements to them, that teachers make more housekeeping, disciplinary and emotive remarks than any other kind. Other evidence exists that teachers spend much time in organizing, maintaining and controlling pupils.

The Place of Simulation in the Educational Milieu

A promising possibility of breaking this restrictive environment of the classroom is the introduction of simulations. Gordon states:

> Among recent innovations, educational games offer great promise of furthering this change. Not only are they fun, but they require that all players share in making decisions throughout the game. Unfortunately, educational games are not well understood. They are not widely available, and experience with them is necessarily limited; as a result, a mystique surrounds the technique. To complicate matters, the use of games implies a seeming irreverance toward education.
>
> Educational games are neither esoteric nor frivolous. But they differ enough from most other classroom activities to raise questions about the role of the teacher, the time and space required, how to evaluate what games teach students, the benefits and drawbacks of using games.[2]

---

1. Benjamin S. Bloom, Taxonomy of Educational Objectives: Handbook I - The Cognitive Domain. (New York, David McKay, 1956.)

2. Alice Kaplan Gordon, Games for Growth (Palo Alto, Calif.: Science Research Associates, 1970), pp. 2-3.

Simulations, and the term is used here as the all encompassing term for games and simulations, bring into union thought and action; reminiscent of the "learn by doing" of the John Dewey era in education. The validity of this change is found in its type. Simulation does not (or should not) represent change in what materials to manipulate, but rather in how to think. Now when Bloom's Categories of cognitive skills are reviewed, it can be seen that simulations provide the "how" or the process of achieving these skills.

Simulations provide information. Facts are inherent in the designing of the play. A period in history, a technological invention, a great man's life, or a trip to the moon all represent types of information. Even more important, pupils learn the existence of two or more sets of facts. Many times, these sets are opposed and the player can choose one to play with and therefore incorporate into self. There is presented to the player also a repertoire of actions of his fellow player as knowledge. These are the facts of the affective or feeling domain. They are skills of a different nature, taught indirectly for the most part and most viable in the scheme of living.

Simulations provide comprehension opportunities. The player must understand the worth and the function of his game knowledge in order to be an effective player. Alternatives in understanding knowledge is provided through verbal exchange and observation of others. Coupled with comprehension is application. Once he understands, he must apply his knowledge to the situation represented by the simulation to be effective in his play.

The player learns skills of analysis and synthesis. In order to apply knowledge in playing, decisions have to be made as to what, when, how or why. Situations must be analyzed and synthesized to take on an idiosyncratic mode. When many avenues of play are open to him, he may, by rejecting all ways, devise or synthesize a new way for him. This is one of the exciting features of simulations. The synthesis or spin offs make playing games the close approximation of life for which they are intended.

Finally, in the cognitive domain, simulation provides an arena for evaluation "How was the material used", "Does this represent real life to you?" "What would you have done differently?" These questions are but a few of those that can be asked in an evaluation, discussion or de-briefing session. Evaluations of this sort are not generally available to the teacher of the pupil in the traditionally taught classroom. In summary then, simulations carry within their format all the basics and processes for developing higher cognitive skills of learning and interaction.

Remote Island and the Taba Scheme for Learning Higher Cognitive Skills

Taba states:

> There are a number of assumptions about the nature of thinking which have tended to retard educational progress in development of thinking skills. One has been that individuals must accumulate

a great deal of factual knowledge before he can "think" about important problems related to himself and his world. (A corollary to this has been the assumption that learning to think is memorizing the thoughts of others.) Another has been that thinking skills are only learned through so-called intellectually demanding subjects such as the physical sciences, mathematics and foreign languages. Still another has been that abstract thought is a capacity that only some individuals, usually the very bright or "gifted" possess. A fourth has been that is is futile to attempt to manipulate the environment in order to improve thinking significantly.[3]

This popular assumption of educationists was not embraced by Taba. Another set of beliefs became the basis for a logical set of cognitive thinking skills: cognitive skills were seen as dynamic interaction between individuals and the stimulation he receives. Learning is not a passive approach to the data. Thinking skills can be learned but they cannot be "given" to pupils by teachers. Thinking is not relegated to any one subject but to processing data. Precise teaching strategies can be developed that allow thinking to be learned. A thinking process is a specific thing and should be taught as such.

Based upon these general assumptions, Taba has developed a cognitive scheme composed of three levels. The first level involves discriminating, listing, grouping and labeling. The child, as his first learning task, separates parts from the wholes or units. He discriminates dogs from an animal whole composed of cats, lions, tigers and so forth. He lists the dogs by counting and calls them dogs. That is, he groups and labels them. This thinking concept, learned as a first way of thinking is carried through life as a basic approach to all new situation problems. A person will invariably want to know what are the component parts of any new situation, how many of them there are and what they are called.

At the second level the pupil learns to interpret the data. He processes the data by exploring relationships, causal factors and linkages to past experiences. An example would be the type of topography demanded for certain living conditions. Why do people live where they do? From these explorations of the data, a person formulates generalizations. He can then use the data to test the universality of the concept. Does the generalization apply to all kinds of situations or to just some and under certain conditions.

Finally, the third level has to do with the application of what one knows, to predict from known phenomena, or to hypothesize on causes and effects, to theorize. Synthesizing solutions for innovating use fits into this highest level of cognitive processing. Testing out solutions gives the pupil a better chance at concreting proper fit, changing for fit or recognizing misfit of concepts. In most classrooms this approach to learning is not available to the pupil population in the present day scheme of education.

---

3. Hilda Taba, The Taba Curriculum Development Project in Social Studies (Menlo Park, Calif., Addison-Wesley Publishing Company, 1969) p. 13.

This author has attempted to blend a practical technique to this cognitive scheme in the form of a simulation called Remote Island. Remote Island is a map skills, geographical relations and ecology decision making game. Basically, Remote Island is a small group game played by six people. It concerns a hypothetical island located in the south Pacific and is divided into three stages of play. In sequence one, basic data is given in the form of history of the island: The island was discovered about 1750 when a frigate was shipwrecked there. Later the surviving men were rescued. The island was lush and inhabitable, fully to support life. During World War II, Japan used it as a submarine refueling base and claimed ownership. In 1950 United States gained ownership in a trade from Japan. Our government sold it to interested parties for 1500 dollars per acre with a maximum purchase of five acres allowed any one person, no companies could purchase land. By 1970 the population of the island was 700,000 with a yearly increase of 10,000.

A problem exists on the island. Because no major industry has been allowed on the island, the people are forced to import manufactured goods. This causes money to leave the island and the standard of living is becoming unsatisfactorily low. The inhabitants of the island have decided with permission of the United States to allow industry to come into their communities. There is known to be large deposits of iron and tin located on the island. With this basic information sequence one continues with the presentation to each member of the playing group of a map card containing one geographical feature of the island. Each card is different from all the others. As each member of the group describes the content of his card to other members, they copy his card's content on their master map card. In this way Taba's first level of cognitive learning is achieved. Each person at the end of this phase has the same primary information, knows how many geographical features the island has and their names.

In the second phase the players are directed to consider the geographical features in placing three large cities and as many small cities as they see necessary on their maps. They are also asked to place highways. In this manner Taba's second level of cognitive skills is realized. The pupil has to establish relationships between geographical structure and placement of man's habitats, to predict longevity of the cities, activities of the people. Through group activity they are able to better approximate realistic conditions of placing cities and transportation. The dynamics of interacting with the material and other persons increases the viability of the data. Learning in this mode is readily internalized. The teacher does not have to show where placement must be. The child learns by doing it. He learns from using his own past experience that cities don't start where arid conditions exist when there are other alternatives for locating.

During phase three, information is given to the group that a large iron mine and smelter owner is interested in mining the iron and locating a smelter on the island for processing and selling the iron. He promises a handsome profit. The group of players now become representative members of the community. They are assigned role of a housewife who is mildly intereste in the activity, a hippie who has left the middle western United States because of the way polution is being managed, a retired biology professor from a middle western university who is an expert on ecology, a fisherman who fishes the surrounding seas of the island, the owner of the mine and smelter in the States and a small town politician who lives near the iron deposit who can provide labor for the mine and smelter. The group becomes a decision making group; the decision concerning whether to let the iron be mined and smelted has to be decided by total consensus in the group. Financial rewards, polution problems, balance of ecology, standards of living, cultural growth, population growth are but a few of the ideas fed into these discussions. Innovative solutions abound.

Debriefing is easily managed after this simulation is played. After experience relating has taken place, questions are asked probing Taba's scheme. Such questions at the first level might include: How many lakes does the island have, how many rivers, what is an arid section of land usually called, how many of these were there on this island?

At the second level questions might be: why is the desert located on the south side of the mountains, why did you place the cities where you did, where would you live on this island if you wanted to raise sheep? When the teacher wants to call indirect attention to level three, he might ask: what does all this mean, will this island look like it does now in 50 years, why do you think that?

<u>Remote Island</u>, as a simulation experience lends itself well to the Taba scheme of cognitive development. In addition to this there are some additional features of learning for the child that are worth mentioning. Social interaction skills in group work are learned indirectly in practice. Modes of presentation of ideas, courtesy factors, group roles are all part of this group process that are not available to pupils in a face-to-back seating arrangement. Playing the game removes the teacher from the position of authority on facts and puts him into the role of managing groups and answering questions. The game is an accurate representation of skills that are needs in life situations. Reading a map is a frequently used technique. In depth reading of maps is a skill that is called attention to by playing <u>Remote Island</u>.

The content of the simulation assumes a lesser place than the structure and function. The cognitive processes represented by this game should be present in all games and simulations to some extent and in some completely.

Summary

Presented in this paper was a stance on the type of games and simulations that should be injected into the educational milieu. Activities of the sort that are highly structured throughout with stringent rules and predetermined outcomes do little more than further the dilemma present in our present day classrooms. Restrictive learning is a predictive result. These results are little better than what the high science of technology is causing at the present time. Games can represent a departure from the noninnovative way of teaching so present today. The question: will games and simulations adopt the form of educational processes today, becomes now valid. The use of games in the classroom is increasing.

There are cognitive schemes for designing these activities. One such scheme is the Taba scheme of cognitive skill acquisition. Remote Island was presented as a mind expanding activity. Facts were learned, relations were established and data was used in decision making. A wide variety of alternatives were available to the players.

THE EFFECT OF INSTRUCTIONAL GAMING UPON ABSENTEEISM: THE FIRST STEP

Layman E. Allen and Dana B. Main

University of Michigan
Ann Arbor, Michigan 48104

The good life is one
inspired by love and
guided by knowledge.

- Bertrand Russell

Background

Focus of Study and Previous Studies

For Russell, the essential features of the good life are affective and cognitive. We submit that these dimensions are also at the core of good learning, which is a central part of human life. This study focuses on the affective dimension as it is influenced by a learning environment organized around instructional gaming.

Other studies have indicated the influence of such a learning environment upon the cognitive dimension. Experimental seventh grade classes using EQUATIONS, the game which is also used in this study, and using the same arrangements with respect to cooperative teams and conduct of tournaments, displayed significantly greater achievement in the learning of mathematics (Edwards et al., 1972). With a different but similar game -- WFF 'N PROOF: The Game of Modern Logic -- and the same other arrangements, groups of junior high and high school students have experienced increases averaging more than 20 points on the non-language parts of standard I.Q. tests (Allen et al., 1966 and 1970). Still another study reports significant differences on I.Q. scores for students using WFF 'N PROOF (Jeffryes, 1969). On the other hand, no significant changes occurred in either the affective or cognitive dimension when the EQUATIONS and TAC-TICKLE games were used for a shorter period without the tournament procedure, which is designed to individualize the problems presented to each learner and to equalize the reinforcements achieved among all members of the class, and without the cooperative features of the learning environment which are introduced by the games (Henry, 1973).

The experimental learning environment arranged for this study emphasizes the affective dimension as a facilitator of cognitive achievement. So the initial question to be answered is whether a learning environment organized around games has a positive effect upon students' attitudes toward learning. That is the fundamental question to thich this study is addressed.

There is some evidence that a learning environment involving EQUATIONS and the appropriate tournament and team arrangements does have positive effects upon students' attitudes toward mathematics learning, as measured by students' responses to an opinion questionnaire (Edwards et al., 1972). A more pervasive measure of student attitudes was sought in the current study -- a measure that would reflect student behavior every day throughout the school term. The student absentee rates in experimental and control classes have been selected as the measure of students' attitudes toward the learning environments of those classes. In addition to being a more pervasive measure than most indicators of attitudes, it is also a pragmatic one. For any program that seeks to enhance the school's effect upon what students learn must first (and necessarily) get the students to come to school.

The Learning Environment Organized around Games

The learning environment arranged for this study contains three major elements, each of which is assumed to be critical with respect to the affective and cognitive effects: a problem-generating type of game; a tournament arranged to award reinforcements frequently and equally among the participants as well as to individualize the learning experience for each participant; and the organization of classes into teams designed to elicit cooperation.

The EQUATIONS game used in this study is a problem-generating game in exactly the same sense that both checkers and chess are. In each game, when a player makes a choice on his turn to play, he constructs a problem for the other player(s). When the other player responds, he attempts to cope with the problem that has been posed for him. The choice that he makes, in doing so, in turn constructs a problem for the next player. That process continues throughout the course of play -- successive generation, resolution, and further generation of problems by players. A player who is seeking to win will pose for the other players the most difficult problem that he can imagine in the circumstances. So the level of difficulty of problem confronting a learner will depend upon the imagination and knowledge of the other players in the game. The more a player knows about the game, the more difficult the problems he can pose for others. In EQUATIONS, mathematical ideas are incorporated in the rules in such a way that the more a player knows about mathematics, the more difficult will be the problems that he can pose for other players.

This linkage between what a player knows and the level of complexity of problem that he can generate by his choices in playing has an important implication: it affords a means for individualizing the learning experience for every single student in a heterogeneous classroom. By controlling who plays with whom, one can control the level of complexity of problem that is delivered to each learner, even though the class consists of students of widely differing abilities and knowledge. It can be assured that each learner is confronted with problems that are of the appropriate level of complexity for him.

The second element of the learning environment under study -- namely, the tournament -- controls the complexity of problem delivered. If the players in each game are evenly matched in terms of their understanding of the game, they will tend to generate problems of the appropriate level of difficulty for each other. In striving to win, each will seek to construct the most difficult problem that he can imagine in the situation. When player A constructs the most difficult problem he can for player B -- and they are evenly matched -- player B will need to struggle and think in order to cope with the problem posed. But -- and this is the important part -- the probability will be relatively high that B will in fact be able to cope with a problem that he subjectively perceives as a "tough" one. When a player is involved with problems that he thinks are difficult but that he successfully copes with most of the time, he is likely to generate an image of himself as one who can handle difficult problems in whatever subject the game is about -- an "I can do it!" attitude. By structuring the tournament in such a way that the players are, and continue to be, evenly matched -- even though the students may learn at different rates -- the attention of each player is focused at the outer edge of what he now understands. That is the objective of the tournament arrangement: to keep the players evenly matched so that the problems delivered to each will be on the frontier of what he currently comprehends. To achieve this objective, the performance of each student is audited at the end of every session.

At the beginning of the tournament the class is ranked according to mathematical ability -- by the teacher's judgment, by results on a test, by trial play-offs of the game, or by any other reasonable means. It is not especially important that this ranking be accomplished with great exactitude, because the tournament rules provide for subsequent adjustments. The rank list is then used to assign students to the table where each should play. The first three students should be assigned to Table 1, the next three to Table 2, and so on until all players are assigned. If there is one extra student, the last two tables should have two players; if there are two extra students, only the last table should have two. At the first session of the tournament, every student should play at the table to which he has been assigned. At subsequent sessions a student's table assignment will be determined by his performance in the previous session. For a given session, there will be a high scorer (H) and a low scorer (L) in the game at each table. For the next tournament session the H at Table 1 will remain at that table, the H's at all other tables will move to the next lower-numbered tables (the H at Table 2 will move to Table 1, the H at Table 3 will move to Table 2, etc.), the L's at all tables except the last one will move to the next higher-numbered table, and the L at the last table will remain there. An absentee player is automatically the L at the table where he would have played. At each table that has three players there will also be a player who scores in the middle (M). The M at each table remains there for the next session. This tournament procedure for moving players about results in a player's shifting to more difficult problems when he has performed well and to less difficult problems when he has not.

This tournament structure and its implications for the affective and cognitive experiences of the learners is probably the most significant aspect of the learning environment of this study. The tournament rules have the result that in the long run each student in the class turns out to be H about one-third of the time, M one-third of the time, and L one-third of the time. In terms of the game, what amounts to "winning" and "losing" with respect to other players is shared evenly among all. Each turns out to "win" half the time with respect to others, and to "lose" half the time. In this manner the competitive aspect of this learning situation is carefully controlled, In terms of "wins" and "losses" for purposes of the game, the slow student is not overly-deprived and the fast student is not overly-indulged. Each receives his fair share of each. Reinforcements are evenly shared among all students in the classroom, not unduly heaped upon only a few of the brightest.

Furthermore -- and this may be the most important affective result of this arrangement -- the situation in which each is experiencing such "winning" and "losing" leads the players to "discover" the positive side of "losing." To the extent that participants learn that many deprivational situations may be opportunities for growth, they may be learning one of the most important lessons for improving their problem-solving in general. The player who loses at Table 5 because he did not understand how to subtract negative numbers, but learns how to do so in the process, will have an opportunity to use his new-found knowledge at Table 6 -- and probably to good advantage. On the other hand, the player who wins at Table 3 and moves to Table 2 -- where he may be walloped by the wizards there -- will become aware of the price attached to "winning." When these experiences occur repeatedly, players gain a sense that "winning" is not an unmixed blessing and that "losing" does not fail to have its compensations. They learn to cope with and "live" with both outcomes. That is probably a useful capability for other situations outside the games.

The third element of the learning environment used in this study introduces further cooperation into the situation by organizing the players into teams. In a major sense, the playing of any game is the essence of cooperation: in order to participate and really play a game everyone must voluntarily agree to abide by the rules that define the game. If someone does not, then he is not playing that game. If one tries to move a knight three spaces diagonally in chess, he is not really playing chess; he is doing something else. But it is a different mode of cooperation that is introduced by the teams in an EQUATIONS tournament. They provide a mechanism for further encouraging the learning from peers. Game-play facilitates learning from peers of approximately equal ability. Team organization elicits learning from peers of diverse abilities. Whereas the games are played among students of homogeneous abilities, the teams are made up of heterogeneous groups. Each team should have as members one fast learner, one slow learner, and a sprinkling of players in between. The scoring in the tournament is arranged so that a win by a slow-learning member of a team who plays at the high-numbered tables counts every bit as much for the team score as a win by the fastest learner on the team. The fast learner on each team soon learns that if he wants his team to do well in the tournament, he needs to teach some of the other members of his team some of the things that he knows. Anyone who has ever tried to set up a situation in which bright students teach slower ones knows exactly where the situation usually breaks down -- and that is in keeping the bright students interested. But teams bring into the structure of the tournament a continuing motivation for bright students to teach slower students the relevant subject matter. The members of a team do not play against one another except when two of them accidentally move to the same table. Their team activities are cooperative in nature: working problems together, explaining ideas to each other, working through Instructional Math Play kits together, or talking generally about their strategies for playing the games. Hence the mixed cooperative-competitive environment that prevails in an EQUATIONS tournament involves competition only when homogeneous groups interact (and even then, under the most careful control) and emphasizes cooperation when the interacting group is heterogeneous.

One final comment is appropriate about the learning environment organized around EQUATIONS for purposes of this study. The experimental situation was imbedded in the school curriculum with no disruption of anything else that would otherwise be occurring. There was no special selection of the students for the classes, nor did any of them cease their participation in any other usual activity. If reasons arose for adjusting a student's schedule at the end of the fall term and transferring him into or out of the experimental or control classes, that was done; no control was exercised to prevent such changes for purposes of the experiment. In other words, the experiment was adapted to the demands of the school -- not vice versa. In this respect, if the results of this experimental program seem to warrant adoption of such a program in other schools, it will be capable of being fitted easily into existing school programs. The data collected in this study were obtained not in an antiseptic laboratory environment, but in the ordinary day-to-day setting of Pelham Middle School in inner-city Detroit. We are deeply indebted to three extraordinary educators there for their cooperation and superb efforts in making this study possible: Lewis Jeffries, Principal; Gloria Jackson, Chairman, Mathematics Department; and William Beeman, Mathematics Teacher.

Method

Educational Environments

Two kinds of mathematics classes were studied. The experimental group devoted two mathematics sessions a week to an EQUATIONS classroom tournament; they heard lectures and worked problems during the other three sessions per week. The control group heard lectures and worked problems individually during all five sessions of the week. The principal difference, then, between the two groups was their activities during two class periods a week.

Absentee Rate

The absentee rate, computed for each student participating in the study, is the ratio of the number of days absent to the total number of possible school days. Students participated in the study for one or two terms. Approximately eighty school days per term were used in the study.

Subjects

The study was conducted at Pelham Middle School, Detroit, during the 1972-73 academic year. Every student was enrolled in only one mathematics class, participated in no other mathematics enrichment program, and was enrolled for the full term or terms considered. Students were not tracked according to ability and had no advance knowledge of which sessions would be games or which, nongames. One section was an eighth-grade mathematics class; all other sections were seventh-grade mathematics classes. No seventh-grade student had prior knowledge of EQUATIONS; the eighth grade class had participated in the seventh-grade program the previous year.

Classes

In the X sections, the same teacher taught two games classes and two nongames classes during the first and during the second terms. In the Y classes, the same teacher taught four seventh-grade and one eighth-grade games classes during the first term and four seventh-grade and one eighth-grade nongames classes during the second term. Although it would have been desirable for the experiment to retain all students for both terms, several losses and additions were necessary between the first and second terms because of other scheduling commitments.

Results

Tables 1-3 contain descriptive statistics of the different groups studied. Table 1 presents the descriptive statistics on those students who remained with the same teacher for two terms. Teacher X taught two games and two nongames seventh-grade sections concurrently. Whereas 44 students were enrolled in her games classes for both terms, only 14 students were enrolled in her nongames classes for both terms. Note that the average absentee rates of the 44 games students were .084 the first term and .078 the second term. The standard deviations for both terms are close: .093 the first term and .091 the second. Contrast these to the mean absentee rates of the 14 nongames students: .252 the first term and .295 the second -- more than three times as much absenteeism. The differences are graphically summarized in Figure 1. Each term is divided into four quarters for which the absentee rates of games and nongames classes are plotted. The standard deviations for the nongames group are also close to each other: .189 for the first term and .191 the second.

Teacher Y taught four seventh-grade classes and one eighth-grade class each term -- all games classes the first term and all nongames classes the second. A total of 57 seventh-grade students were enrolled with Y for both terms; 23 eighth-grade students were enrolled both terms. In teacher Y's first-term games classes the seventh-grade mean absentee rate was .076, with a standard deviation of .106. During the second term, when Y's classes were in nongames mode, the mean absentee rate for these same students rose to .130 (nearly double), with an increase in the standard deviation to .140. Eighth-graders in games classes the first term had a mean absentee rate of .057; this rate rose to .131 (more than double) in the nongames second term. The standard deviation increased slightly, to .088.

Table 2 describes data for all students enrolled during the first term in the classes of the two teachers, including those students who transferred out of those classes the second term. Teacher X had 57 students in games classes and 42 students in nongames classes. The

Absentee Rates of Students
in Games (G) and Nongames (N) Classes
of Teacher X in First Term and Second Term

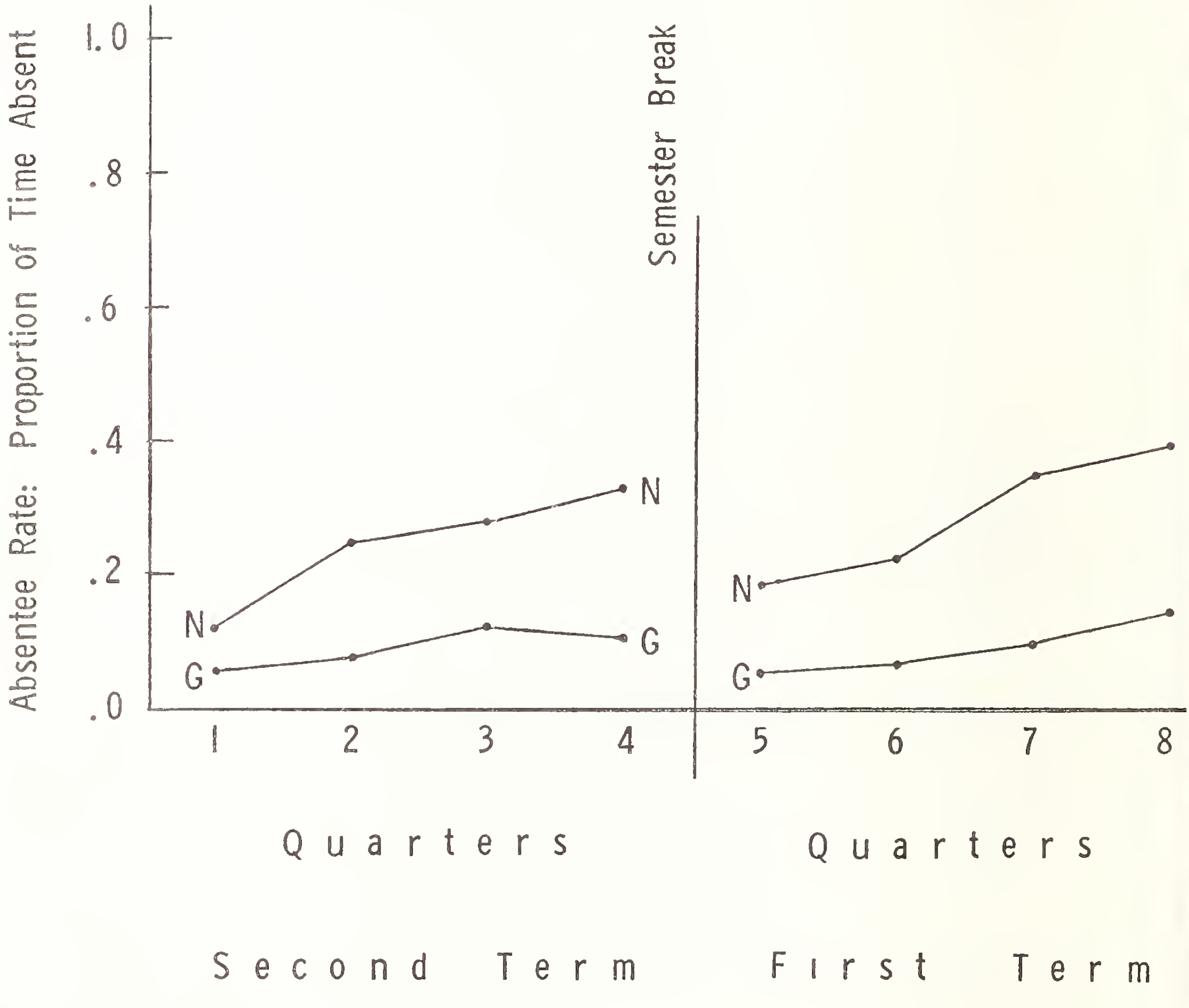


Figure 1

mean absentee rates are comparable to those in Table 1: the rate is .096 for seventh-grade students in the first term; it is .246 for seventh-grade nongames students in the first term, with standard deviations of .105 and .234 respectively. Teacher Y taught only games sections in the first term, with an enrollment of 88 seventh-graders and 31 eighth-graders. The mean absentee rate for the seventh-graders was .111, with a standard deviation of .166; the rate for the eighth-graders was .086, with a standard deviation of .168.

Table 3 presents the mean absentee rates of students enrolled in the second term with Teachers X and Y. Some students had been in games classes, some in nongames classes, during the previous term, and not necessarily with the same teacher. The first column of descriptive statistics is for those students in games sections throughout the first and second terms (GG). The second column describes students in games classes the first term and nongames classes the second (GN). The third column describes students in nongames classes the first term and games classes the second term (NG). The fourth column describes students in nongames classes throughout the two terms (NN). As in Tables 1 and 2, the data are described by teacher and grade; the numbers of students, the mean absentee rates, and the standard deviations are given.

Three general hypotheses about absentee rates in games and nongames classes as indicators of differences in student attitudes are of interest and can be tested by the data available in Tables 1-3. The first hypothesis is concerned with testing whether the mean absentee rates of the games classes are less than those of nongames classes taught by the same teacher. This hypothesis can be tested only with the data from the classes of Teacher X, who was the only teacher to teach both kinds of classes concurrently. The second hypothesis is concerned with testing whether the low absentee rates experienced in games classes in the first term deteriorate significantly when these students are shifted to a nongames class in the second term. A combination of findings -- that games classes have lower absentee rates than nongames classes and that these lower rates tend to disappear when students are subsequently switched to nongames classes -- would constitute strong evidence for attributing the lower absentee rates to the learning situation organized around games. The second hypothesis can best be tested with data from the classes of Teacher Y, who had all games classes in the first term and all nongames classes in the second term, with many of the same students in both. The third hypothesis is concerned with testing whether students who have experienced lower absentee rates through participation in games classes in the first term and are enrolled in nongames classes in the second term (denoted GN) have a lower absentee rate in the second term than students in nongames classes who did not participate in games classes the previous term (denoted NN). In other words, does participation in games in the first term have a carry-over effect which produces lower absenteeism in the second term than there otherwise would be? Data from the second-term classes of both teachers can be related to this question, since each teacher had some GN and NN students whose absentee rates can be compared. These hypotheses are summarized in Figure 2.

Summary of Hypotheses

	Teacher	First Term	Second Term
H_1	X	G --- N	
H_2	Y	G - - - - - - - - - N	
H_3	X, Y		GN --- NN

Figure 2

The first hypothesis can be tested (a) by comparing the absentee rates of students in games and nongames classes of Teacher X for both terms (Table 4); (b) by comparing the absentee rates of all students in games classes and nongames classes of Teacher X in the first term (Table 5); and (c) by comparing the absentee rates of students in games and nongames classes of Teacher X in the second term who had been in the same kind of class the term before but not necessarily with the same teacher (Table 6).

In all instances, the null hypothesis is that there is no difference in the absentee rates of students in games and nongames classes. Table 4's statistics describe the students enrolled with Teacher X throughout both terms (from Table 1). The F ratio indicates that the variances of the two groups are quite different. A Student T statistic, which assumes equal variance, is inappropriate. Therefore, the Behrens-Fisher t* statistic, which adjusts for differences in the N and the variances, is used. The results indicate that the null hypothesis can be rejected at a significance level of $< .005$.

The probability that the mean absentee rate for games classes is less than the mean absentee rate for nongames classes is .9968 for the first term and .9995 for the second term. This is a Bayesian posterior probability statement based on a flat prior probability distribution. It takes into account unequal variances and unequal N's and is based on the Behren-Fisher distribution. An equivalent statement for the first term is $P(\text{Mean}_N \leq \text{Mean}_G \mid \text{Sample}) = 1 - .9968 = .0032$. As the probability approaches 1.00 (or 0.00, depending on how it is stated), the observer can be more certain that the data indicate that one mean is larger than the other. As the probability approaches .500, the observer becomes less certain that one mean is larger than the other. The Bayesian posterior probability is presented as an alternative way to view the data. It does not test the null hypothesis, as the t statistic is designed to do. It simply says that given this sample and no prior knowledge, there is a certain probability that one mean is greater than the other.

Because the number of students enrolled both terms with Teacher X in the nongames group is so small compared to the number of students in the games group in Table 4, it was decided that each term should be analyzed separately. Table 5 contains the analysis for the first term; Table 6, for the second term. Note that the F ratio again indicates a big difference in the variances of the games and nongames groups. Since the games group absentee rate is so close to zero, it is understandable that its variance is considerably less than that for the nongames group. The t* analysis which adjusts for unequal variance and N's is consistent with the former; that is, the null hypothesis can be rejected at a level of significance of $< .0005$. for both terms. The probability that the mean absentee rate for games classes is less than the mean absentee rate for nongames classes is .9998 the first term and 1.0000 the second term.

Turning to the second general hypothesis, the question is: When students are switched to nongames classes following a term with games, does the low absentee rate achieved in the first term deteriorate (increase) in the second term? Tables 7 and 8 present data for students who enrolled for two terms with Teacher Y, in games classes the first term and in nongames classes the second. Table 7 describes seventh-graders; Table 8, eighth-graders. The matched t analysis indicates a highly significant difference between absentee rates for the first-term games and the second-term nongames classes.

The null hypothesis that the absentee rates of students in games classes the first term are not less than their absentee rates in nongames classes in the second term must be rejected for both seventh and eighth graders: the significance level of the t for matched groups in both cases is .0000. The mean absentee rate for seventh graders in nongames classes was nearly double that in games classes (.076 to .130), and that for eighth graders was more than double (.057 to .131).

The third, and final, hypothesis deals with the possibility of some carry-over effect from participation in games in the first term to lessen absenteeism in the second term. Absentee rates were compared for two groups of students enrolled in nongames classes in the second term: one group of students had been in games classes in the previous term (GN), one group had been in nongames classes in the previous term (NN). The data are summarized in Tables 9-11. The null hypothesis is that the second-term absentee rate of GN students is not less than that of NN students.

Table 9 summarizes the data for the seventh-grade students of Teacher X. The second-term mean absentee rate was .193 for GN students compared to .270 for NN students, a .077 difference. Since the F ratio indicates a difference in the variances at a .0222 level of significance, the Behrens-Fisher t* value was computed (t* = 1.272). This is not significant at the .05 level ($t^*_{.05}$ = 1.764 and $t^*_{.10}$ = .694 by the Cochrane-Cox approximation); however, it is significant at < .10. The evidence for rejecting the null hypothesis is marginal; it can only be rejected at the .10 level of significance. An alternative way of characterizing the evidence is by a Bayesian posterior probability statement: $P(\text{Mean}_{GN} < \text{Mean}_{NN} \mid \text{Sample}) = .8980$.

The data for Teacher Y's seventh- and eighth-grade classes, summarized in Tables 10 and 11, support this marginal finding with respect to the carry-over effect. The difference in mean absentee rates for the seventh-graders was .033 (.127 to .160) and .086 for the eighth-graders (.131 to .217). These, too, were significant only at the < .10 level. The respective Bayesian posterior probability values were .8330 and .7835.

In summary, the results indicate the following:

(1) The probability is .999+, given these samples, that the absentee rate for students in games classes is less than that for students in nongames classes. The null hypothesis that the absentee rate for students in

games classes is not less than that for nongames classes can safely be rejected. In these samples the mean absentee rate in nongames classes was more than three times that in games classes.

(2) There is a statistically significant rise in the absentee rates of students switched from games classes in the first term to nongames classes in the second term. The rates just about double. The null hypothesis that there is no increase in absentee rates when students transfer from games to nongames classes can safely be rejected.

(3) The evidence for carry-over effects, however, is tenuous. Although students from nongames classes in the second term enrolled the previous term in games classes are more likely (about .8) to have a lower absentee rate than other nongames students enrolled the previous term in nongames classes, the data is marginal for rejecting the null hypothesis that there are no carry-over effects to lessen absenteeism in the second term. The null hypothesis can be rejected only at the significance level between .05 and .10.

Discussion

That there are profound effects upon absenteeism in the Detroit innercity school where this study was conducted when an EQUATIONS instructional tournament is introduced into the regular mathematics curriculum is beyond reasonable doubt. The evidence is clear that absences drop markedly. Interpreted as an indicator of students' attitudes toward school and what is being done there, such lower absenteeism is perhaps one of the strongest and most pervasive gauges possible of the affective influence of a procedure. To the extent that such gaming techniques jolt this affective dimension, they undoubtedly set the stage for influencing the cognitive dimension. It is hard to improve the way Russell said it in discussing the good life:

> Although both love and knowledge are necessary, love is in a sense more fundamental, since it will lead intelligent people to seek knowledge in order to find out how to benefit those whom they love.

With the games, it is clear, there can be success in creating the love. The next question is obvious: Does it lead to the seeking and achievement of knowledge? In intelligent hands, it should. On this dimension, we need to find out more.

REFERENCES

Allen, L. E., Allen, R. W. & Miller, J. C. Programed Games and the Learning of Problem-Solving Skills: The WFF 'N PROOF Example, THE JOURNAL OF EDUCATIONAL RESEARCH, Vol. 60, No. 1, September 1966.

Allen, L. E., Allen, R. W., and Ross, J. The Virtues of Nonsimulation Games, SIMULATION AND GAMES, Vol. I, No. 3, September 1970, 319-326.

Edwards, K. J., and DeVries, D. L. LEARNING GAMES AND STUDENT TEAMS: THEIR EFFECTS ON STUDENT ATTITUDES AND ACHIEVEMENT, Center for Social Organization of Schools, Johns Hopkins University, Report No. 147, December 1972.

Edwards, K. J., DeVries, D. L., and Snyder, J. P. Games and Teams: A Winning Combination, Vol. 3, No. 2, SIMULATION & GAMES, September 1972.

Henry, K. M. THE EFFECT OF GAMES ON COGNITIVE ABILITIES AND ON ATTITUDES TOWARD MATHEMATICS, Ph.D. Dissertation, Oregon State University, 1973.

Jeffryes, J. Let's Play WFF 'N PROOF, THE MATHEMATICS TEACHER, Vol. 62, No. 2, February 1969.

Russell, Bertrand. WHAT I BELIEVE, Allen & Unwin, London, 1925. Reprinted in WHY I AM NOT A CHRISTIAN, Simon & Schuster, New York, 1957.

Table 1

Absentee Rates for Students Enrolled

in Games and Nongames Classes

of Teacher X and Teacher Y for the Full Year

	Teacher	Grade	First Term		Second Term	
			Games (G)	Nongames (N)	Games (GG)	Nongames (NN)
	X	7				
No.			44	14	44	14
Mean			.084	.252	.078	.295
S.D.			.093	.189	.091	.191
						Nongames (GN)
	Y	7				
No.			57	—	—	57
Mean			.076			.130
S.D.			.106			.140
	Y	8				
No.			23	—	—	23
Mean			.057			.131
S.D.			.071			.088

Table 2

Absentee Rates for Students Enrolled

in Games and Nongames Classes of

Teacher X and Teacher Y for the First Term Only

	Teacher	Grade	First Term	
			Games (G)	Nongames (N)
	X	7		
No.			57	42
Mean			.096	.246
S.D.			.105	.234
	Y	7		
No.			88	——
Mean			.111	
S.D.			.166	
	Y	8		
No.			31	——
Mean			.086	
S.D.			.168	

Table 3

Second Term Absentee Rates for Students Enrolled in the Games and Nongames Classes of Teacher X and Teacher Y in the Second Term, Some of Whom Were Enrolled with Other Teachers Or in Different Kinds of Classes in the First Term

	Teacher	Grade	Term	Kind of Class			
			First Second	Games Games (GG)	Games Nongames (GN)	Nongames Games (NG)	Nongames Nongames (NN)
	X	7					
No.				46	10	9	36
Mean				.082	.193	.107	.270
S.D.				.092	.128	.111	.244
	Y	7					
No.					55		25
Mean				——	.127	——	.160
S.D.					.142		.136
	Y	8					
No.					23		10
Mean				——	.131	——	.217
S.D.					.088		.327

t*-Analyses of Absentee Rates in Games and Nongames Classes (Tables 4-6)

Null Hypothesis H_1: The absentee rates in games classes are not less than the absentee rates in nongames classes.

Table 4

Absentee Rates of Seventh-Grade Students Enrolled

in the Games and Nongames Classes of Teacher X for Two Terms

	First Term		Second Term	
	Games (G)	Nongames (N)	Games (GG)	Nongames (NN)
No.	44	14	44	14
Mean	.084	.252	.078	.295
S.D.	.093	.189	.091	.191
	Value	Significance Level	Value	Significance Level
F	4.1522	.0002	4.4084	.0001
t	not appropriate		not appropriate	
t* obs	3.20	> .0005 < .005	4.11	> .0005 < .005
t*.005	2.99		2.99	
t*.0005	4.17		4.17	
	$P(\text{Mean}_G < \text{Mean}_N \mid \text{Sample}) = .9968$		$P(\text{Mean}_{GG} < \text{Mean}_{NN} \mid \text{Sample}) = .9995$	

Table 5

Absentee Rates of Seventh-Grade Students Enrolled
in Games and Nongames Classes of Teacher X in the First Term

First Term	Games (G)	Nongames (N)
No.	57	42
Mean	.096	.246
S.D.	.105	.234
	Value	Significance Level
F	4.9814	.0000
t	not appropriate	
t* obs	3.88	< .0005
t* .0005	3.54	
	$P(\mathrm{Mean}_G < \mathrm{Mean}_N \mid \mathrm{Sample}) = .9998$	

Table 6

Absentee Rates of Seventh-Grade Students Enrolled

in Games and Nongames Classes of Teacher X in the Second Term

Second Term	Games (G)	Nongames (N)
No.	46	36
Mean	.082	.270
S.D.	.092	.244
	Value	Significance Level
F	7.0626	.0000
t	not appropriate	
t* obs	4.39	< .0005
t* .0005	3.54	
	$P(\text{Mean}_G < \text{Mean}_N \mid \text{Sample}) = 1.0000$	

Matched t-Analysis of Absentee Rates of Students who Switched from Games to Nongames Classes (Tables 7-8)

Null Hypothesis H_2: The absentee rates of students in the first term when they were enrolled in games classes are not less than the absentee rates of those same students in the second term when they were enrolled in nongames classes.

Table 7

Absentee Rates of Seventh-Grade Students Enrolled in the Games and Nongames Classes of Teacher Y for the First and Second Terms

	First Term Games (G)	Second Term Nongames (GN)
No.	57	57
Mean	.076	.130
S.D.	.106	.140
Mean difference		.054
S.D.		.076
t		5.3301
Significance level		.0000

Table 8

Absentee Rates of Eighth-Grade Students Enrolled in the Games and Nongames Classes of Teacher Y for the First and Second Terms

	First Term Games (G)	Second Term Nongames (GN)
No.	23	23
Mean	.057	.131
S.D.	.071	.088

Mean difference	.073
S.D.	.066
t	5.3091
Significance level	.0000

t- and t*-Analyses of Absentee Rates in Games-Nongames and Nongames-Nongames Classes (Tables 9-11)

Null Hypothesis H_3: The absentee rates of nongames students in the second term who were enrolled in games classes the first term are not less than the absentee rates of other nongames students in the second term who were enrolled in nongames classes in the first term.

Table 9

Absentee Rates in the Second Term of Seventh Grade Students Enrolled in

(1) Nongames Classes of Teacher X the Second Term and

(2) Games or Nongames the First Term (Not Necessarily with Teacher Y the First Term)

	Absentee Rate in Second Term	
First Term Second Term	Games Nongames (GN)	Nongames Nongames (NN)
No. Mean S.D.	10 .193 .128	36 .270 .244
	Value	Significance Level
F	3.6584	.0222
t	not appropriate	
t* obs	1.34	> .05 < .10
t* .05	1.76	
t* .10	.69	
$P(\text{Mean}_{GN} < \text{Mean}_{NN} \mid \text{Sample}) = .8980$		

Table 10

Absentee Rates in the Second Term of Seventh Grade Students Enrolled in

(1) Nongames Classes of Teacher Y the Second Term and

(2) Games or Nongames the First Term (Not Necessarily with Teacher Y the First Term)

	Absentee Rate in Second Term	
First Term Second Term	Games Nongames (GN)	Nongames Nongames (NN)
No.	55	25
Mean	.127	.160
S.D.	.142	.136

	Value	Significance Level
F	1.808	.4299
t	.9742	> .05 < .10

$P(\text{Mean}_{GN} < \text{Mean}_{NN} \mid \text{Sample}) = .8330$

SIMULATION/GAMING: AN AUTOTELIC INQUIRY TECHNIQUE

By Ron Stadsklev
Assistant, Institute of Higher Education
Research and Services
The University of Alabama
Huntsville, Alabama 35807

Today the term simulation/game is used to cover a multitude of activities and materials. It is a catchy term that has become fairly popular in the educational field. If you want to sell something, don't call it role playing, don't call it an instructional game, don't call it an autotelic inquiry technique; call it a simulation game. Teachers' ears pick up when they hear that term. It seems to me that a more inclusive term could be used to refer to these activities and materials. I offer for consideration the term "autotelic inquiry techniques." It is apparent today that the "inquiry approach" is the popular way to structure learning. However, I would contend that most of the inquiry taking place today is not "autotelic", meaning inquiry in which the activities of the student are self-directed toward a purposeful end. The normal pattern is something like this: "Class, we will meet in the library for the next two days," says the teacher. "We will break into seven committees, and I want each committee to study one of the seven continents on our globe and find out what the chief characteristics of each continent are. Now go inquire. Reports will be due in two days." Instead of telling the students what she thinks they should know, she has them discover it for themselves---she lays inquiry on them. It may be a form of inquiry, but is it autotelic? Does the activity the student is engaged in interest him enough to want to do it? Does it relate directly to some felt need?

Five Techniques

To my way of thinking, a simulation game is just one of a group of experimental learning techniques that tend to elicit a large degree of autotelic inquiry. The model illustrated in Figure 1 depicts five such techniques: learning games, role playing, instructional games, social simulations, and simulation games. It seeks to show a building relationship from simple to complex, with simulation games being the most sophisticated.

At the bottom of the model is an area labeled "Mental Garage", which is intended to represent the human mind. Two thoughts are housed in this garage, one about educational philosophy and one about learning theory. They constitute the basic assumptions underlying the rationale for using these techniques. As far as educational philosophy goes, we work from the assumption that says that experimental learning is where the real pay-off is. Students do not learn by being taught. They learn by experiencing the consequences of their actions; in other words, by having to cope with their environment. If you don't buy these two assumptions, you probably won't relate to the techniques identified above, because they are built on these assumptions.

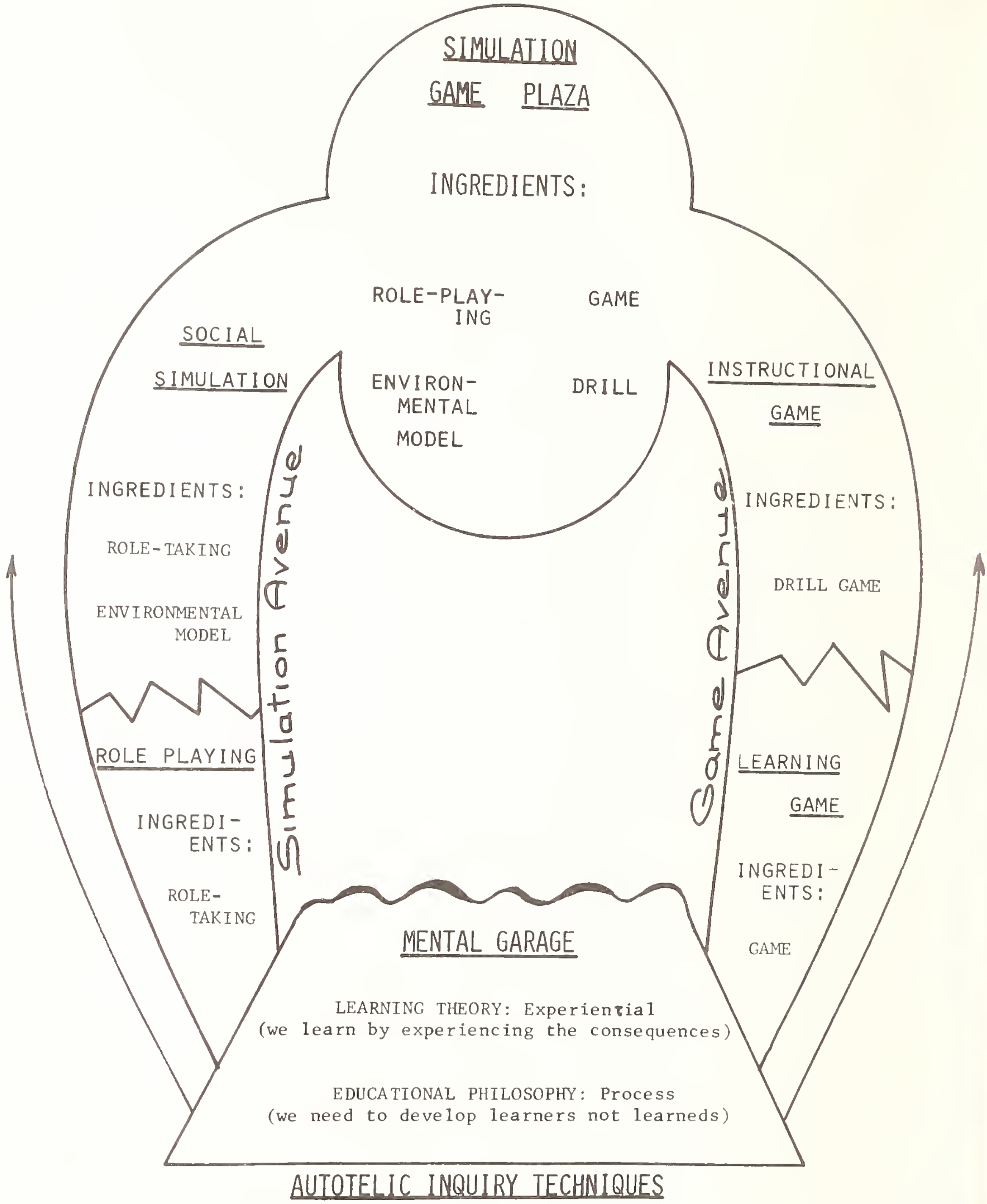

SIMULATION
GAME PLAZA
INGREDIENTS:
ROLE-PLAY-ING
GAME
ENVIRON-MENTAL MODEL
DRILL
SOCIAL SIMULATION
INGREDIENTS:
ROLE-TAKING
ENVIRONMENTAL MODEL
ROLE PLAYING
INGREDI-ENTS:
ROLE-TAKING
Simulation Avenue
Game Avenue
INSTRUCTIONAL GAME
INGREDIENTS:
DRILL GAME
LEARNING GAME
INGREDI-ENTS:
GAME
MENTAL GARAGE
LEARNING THEORY: Experiential
(we learn by experiencing the consequences)
EDUCATIONAL PHILOSOPHY: Process
(we need to develop learners not learneds)
AUTOTELIC INQUIRY TECHNIQUES

Figure 1

From Mental Garage we move out in two directions, one called Simulation Avenue (where we manipulate people) and the other called Game Avenue (where we manipulate things). The first step up either avenue brings us to relatively simple and unsophisticated techniques. On Game Avenue we come immediately to learning games. These are defined as simple game exercises which, if effectively analyzed, can lead the participant to some learning about himself and about interpersonal relationships. It has one ingredient, namely game element. You are all well aware, I am sure, of the constantly expanding usage of the word "game" and the growing list of definitions. For the purposes of this model I will use Clark Abt's definition, which states that a game is a contest (play) among adversaries (players) operating under constraints (rules) for an objective (winning). Examples of learning games would be the T-Puzzle Game, the Wood Blocks Game, the Bridge-Building Game, and many of the exercises designed by human relations people such as Pfeiffer and Jones in their four-volume publication entitled A Handbook of Structured Experiences for Human Relations Training.

Going up Simulation Avenue, we move into role-playing technique. In this technique, participants take roles and act them out in a simple scenario. Here again we have simply one ingredient, role-taking. Role playing is the practice or experience of "being someone else," or perhaps being oneself in a new situation. Again, the human relations world makes extensive use of this technique. Examples of pre-packaged materials would be You, Actionalisis, or Can of Squirms.

As we continue up Simulation Avenue, we gradually move into something a little more sophisticated, which may be called a social simulation. This involves the use of role-taking during the operation of a comparatively complex environmental model of an actual or hypothetical social process. It will give a selective representation of realty, containing only such elements of reality as the designer deems relevant to his purposes.

This technique adds another ingredient to role playing, namely "environmental model." I use this term to designate a set of interrelated factors or variables which together comprise elements that are symbolic of a social system. The variables utilized are limited to those needed to ensure that the model will possess a degree of likeness to reality (isomorphism). Often it is hard to discern where the scenario used to set up the role for the participants becomes an environmental model--hence the jagged line used to divide the two techniques. Examples of social simulation would be Portsville, 1787 and The Lovable Church.

As we move up Game Avenue, we will discover an instructional game which also has two ingredients: game (which has already been defined), and drill (which is simply the process of practicing and repracticing). Instructional games present knowledge or information in a gaming process, and one must gain some cognitive understanding of this information in order to function well in the game. Examples of this technique would be

System I, Propaganda, and Queries'n Theories. Again, the jagged line is used to indicate the difficulty of discerning the exact point at which a learning game becomes an instructional game.

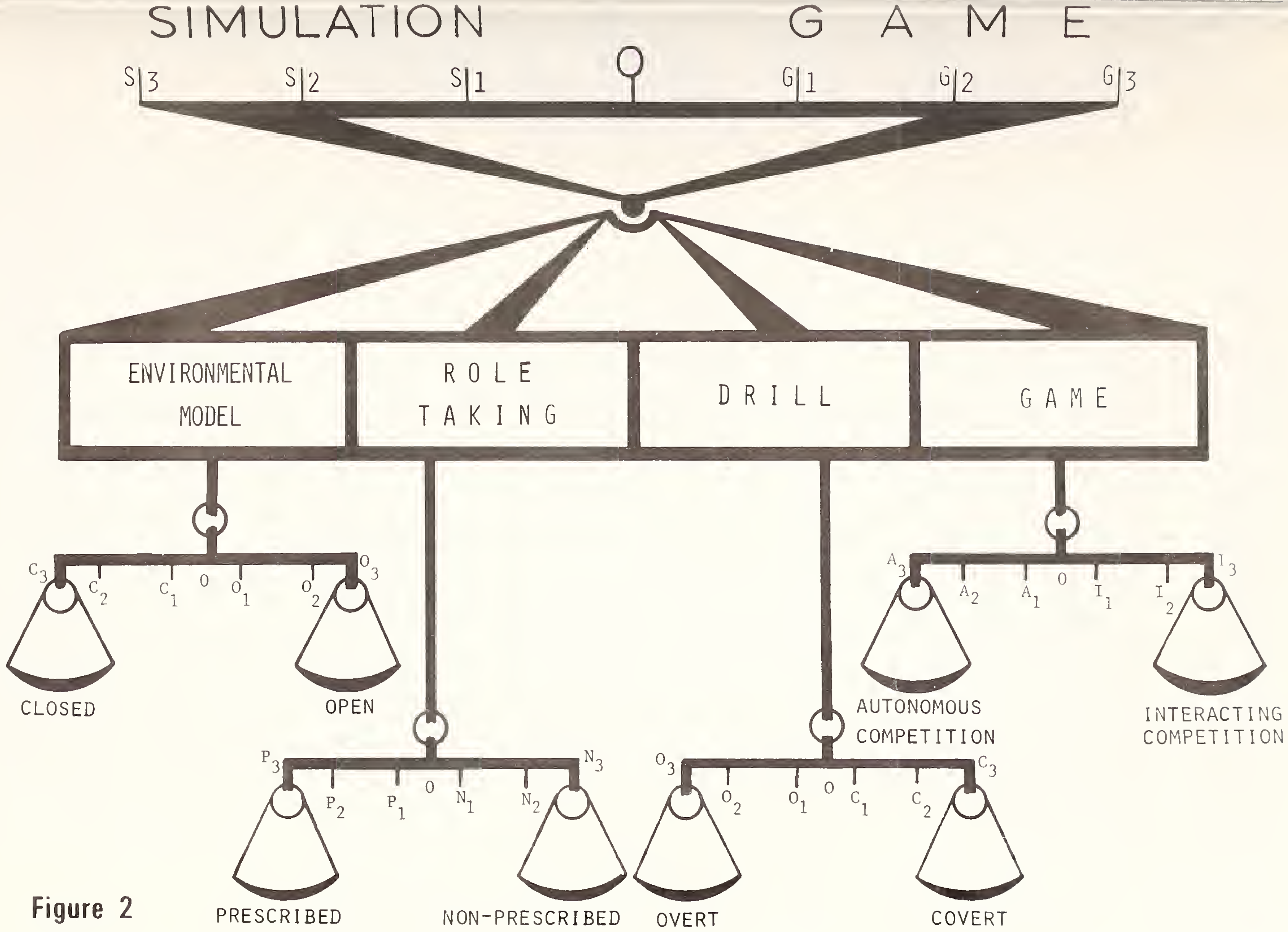
The next step on either avenue brings us into Simulation Game Plaza. This is where we put it all together. Social simulations are nothing new in educational settings, as anyone that has ever conducted a mock trial or election knows. Instructional gaming is old as the hills; even Daniel Webster had spelling bees. If there is anything new in the world (and I am not sure there is), it is the attempt to merge social simulation with an instructional game and receive the benefits of both techniques in trying to reach the participants and turn them on. If the simulated experience doesn't hook them, then the game experience might. A simulation game, then, is a sophisticated technique involving the use of role-taking during the operation of a comparatively complex environmental model of an actual or hypothetical social process instilled into game form. It represents reality selectively containing only those elements that the designer deems relevant to his purpose. Examples of simulation games would be Ghetto, Starpower, and The Game of Farming. It seems to me that a simulation game is much more of a challenge to the designer than any of the other techniques. This is because of the inherent difficulty involved in trying to build in entertaining and playable game elements without producing great distortion in the isomorphism of the environmental model. Many hours of trial and error will be necessary in order to come up with just the right mix.

Analytical Scales

If simulation games are frustrating to design, it is even more frustrating for users to attempt to get a handle on what games are and how they operate. For this reason, I have been trying to develop a set of analytical scales that might provide quick but meaningful information for the potential user.

Figure 2 illustrates an effort to measure each of the four components of a simulation game. The scale used to measure the game component has, on one end, the term "autonomous competition," and on the other, "interacting competition." Autonomous competition is that in which one participant's actions do not directly affect the others. Each demonstrates his best performance without any interference from the other and then compares results. An example of an A3 game element would be golf. Chess, on the other hand, would be an example of an I3 on the game scale, because every move that one participant makes affects the other participant's move in a variety of ways.

The drill component is built into a simulation game in either an overt or covert fashion. Ghetto might be an example of a C2 or C3, since students are certainly going to be practicing and repracticing arithmetical procedures but will probably not perceive it as drill, while in a game like Campaign all players quickly discover the need to become



SIMULATION
GAME
S 3
S 2
S 1
0
G 1
G 2
G 3
ENVIRONMENTAL MODEL
ROLE TAKING
DRILL
GAME
C3
C2
C1
0
O1
O2
O3
CLOSED
OPEN
P3
P2
P1
0
N1
N2
N3
PRESCRIBED
NON-PRESCRIBED
O3
O2
O1
0
C1
C2
C3
OVERT
COVERT
A3
A2
A1
0
I1
I2
I3
AUTONOMOUS COMPETITION
INTERACTING COMPETITION

Figure 2

proficient in the rules of parliamentary procedure in order to function well. The chairman may even go as far as to take time to drill openly the rules with his workers so they can be more effective in the parties' deliberations. Hence, this game weighs out on the overt end of the scale.

I think the scale we can use to measure the role-taking component is "prescribed" and "non-prescribed." Culture Contact would be an example of a P3 simulation game. In this game players are told such things as what colors they like, what attitudes they hold, and even how they move their body when they sepak. Prescribed role playing can be very difficult to work with unless you have a good setting, with people with the right kind of personalities. Non-prescribed role-playing is illustrated best in a game called They Shoot Marbles, Don't They? Here one is asked only to try to acquire marbles. One is given roles such as policeman, government official, landowner, etc., but is completely free to fill that role in any manner one desires.

The environmental model component, which I feel is the heart of a simulation game, is measured on a scale running from "closed" to "open." In a closed model game like Ghetto, someone designs a very tightly organized structure comprised of just the components they want the participants to experience. The participants then interact with this model, and their actions are usually highly predictable. The more closed the model, the more predictable their actions are. In an open model game like Starpower, one does not create a model of reality and then have participants interact with it. On the contrary, in open-model gaming the participants create the model. The game presents a goal for the participants to seek, then provides a few broad parameters to control their actions. When the participants begin to interact in order to achieve their goals, they create a model of reality. Open-model gaming is very unpredictable and requires the game director to deal with many unforeseeable situations.

The scale at the top of the model applies to the simulation game in its entirety. Most simulation games tend to lean either towards a strong simulation element but not much game flavor, as in the case of games like Campaign and Tracts, or be very gamely but have a weak simulation element, as in the game Blacks and Whites. As stated in the first part of this paper, achieving a good balance between these two elements is probably the essence of success in designing a simulation game.

DESIGN TASK GROUP
Developing Computer Based Simulations
Facilitator's Statement

ROY I. MILLER
Environmental Simulation Laboratory
School of Natural Resources
University of Michigan
Ann Arbor, Michigan USA 48104

Unless an overly narrow definition of computer-based simulation is adopted by this sub-group (for example, one limiting consideration to the large urban models), all of the other topics discussed in all other "design" sub-groups are relevant to this one. After all, the process of designing a computer-based simulation has all of the problems associated with the design of any simulation -- plus one, the ornery (and expensive) machine. As a self-protective measure, this author opts not to impose such a narrowly construed definition on a group so likely to be heterogenous as this one. Therefore, I will put forth a broad definition of computer-based simulation and I will narrow the scope of the discussion by concentrating on those issues that are particularly challenging for designers of computer-based simulations.

Three terms are too often used interchangeably to describe "things" generally included in the discussion of simulation: pure simulation, game, and gaming-simulation. "Pure simulation" is an attempt to reproduce a real world process (social, political, economic, physical, etc.) in an abstract form without any direct human participation in the reproduction. For convenience, we limit the term "game" to encompass activities carried out by groups of people according to some pre-set rules. Usually, though not necessarily, the term implies that the results of the "game" do not have real world implications beyond the learning experience generated in the game environment. "Gaming-simulation" is a combination (or in set-theoretic terms, the intersection) of the two -- a reproduction of a real world process in an abstract form in which human participation governed by a set of rules is an integral part. Those simulations using the computer for accounting purposes, for data retrieval, for decision making and/or to recreate system behavior through pure simulation are computer-based.

As a starting point for discussion of issues associated with developing computer-based simulations, it is useful to identify three broad problem areas. The first is the design decision to resort to a computer-based simulation. The second is the technical decision concerning hardware and software. Finally, several theoretical questions must be resolved separately for each computer-based simulation.

For many years, elaborate statements of the advantages of the computer have been contrived to justify its use in simulation. These include such arguments as: the machine allows you to view systems dynamically, it lets you deal better with complexity, it allows for reproducibility of experiments, it makes possible sophisticated data manipualtion and analysis, etc. Although cases can be cited where the computer has made possible the realization of these claims, too many cases are on record where it clearly has not. To avoid further misuse of the computer, the decision to develop a computer-based simulation must be made with some care. This sub-group might seek to identify some criteria for making such a decision.

Once into the development of a computer-based simulation, the designer is immediately faced with several technical problems. He must select hardware and decide which computer language is best suited for software development. These choices must be made with such thoughts in mind as dissemination, future technological changes in the computer field, and costs. He must also assemble a team of computer specialists as well as experts in the subject matter of the simulation. The value of many computer based projects (including computer-based simulation work) has been sorely limited due to poor choices on these matters. Lack of transferability and dependence on one or two key programmers have minimized the impact of many computer dependent projects. Again, this sub-group might seek some criteria for dealing with these technical issues.

Finally, and most interestingly, several theoretical questions must be resolved by the designer of a computer-based simulation. Each of these questions is relevant to non-computer simulations; however, the power of the computer creates more options for the designer of computer-based simulations and, therefore, each must be considered with extraordinary care. These include such questions as:

What is the relationship between data gathering and theory building (how do you allocate resources between the two and which comes first)?

What is the appropriate level of abstraction for the simulation?

What is the appropriate level of aggregation of key variables in the simulation?

How do you deal with the non-quantifiable?

How much human participation do you build in and, if you use any, how do you build the man-machine interface?

How do you narrow the topic to something workable, yet usable?

How do you validate the results of the model?

This sub-group might first expand this list of pertinent questions and, then, attempt to get a feeling for how to answer them.

DESIGNING COMPUTER-BASED SIMULATIONS
FACILITATOR'S STATEMENT

MARSHALL H. WHITHED
Dept. of Political Science
Temple University
Philadelphia, Pa. 19122, U.S.A.

There are a variety of concerns to be faced, I think, in the design of computer based simulation-games. Some of these questions are briefly outlined in the paragraphs below, with no intention of their being ordered into hierarchies or priorities.

1. Is computerization necessary? Really? It adds an appearance of elegance and mysticism--but also adds burdens of complexity of use (particularly in logistics, particularly for the smaller and less well-equipped school), difficulties of understanding the hidden models (see below), etc. The computer has uses, and sometimes absolutely necessary ones--but sometimes people are designing simulation-games with computer support because the product seems to be more sophisticated.

2. Documentation. Especially, of the models and submodels, both intended by the designer and perhaps also some unarticulated by the designer and representing hidden biases, contained in the computer programming. Without documentation, unless the reader/user can read the computer programming language, he is unable to ascertain what intended and unintended models and biases may be involved.

2a. Given that adequate documentation is a good thing, how do we get it? Bearing in mind that most of us work in less than ideal conditions with reference to staff, financial support, our own time, facilities, etc. (And preparation of documentation doesn't help most of us at all in terms of getting hired, promoted, tenure, etc.--one of the only projects I know of which encourages and provides some payoff for documentation labors is Project Compute at Dartmouth--where people receive financial support to spend the summer at Dartmouth preparing user's manuals and documentation).

3. Interface between computer programmer and simul-game designer. Given that most of us are not expert computer programmers, this means we will have to work with a computer programmer professional. How to communicate adequately with him. Indeed, how to find him, first of all (remember inadequate budgets, etc.). And how to make sure that he doesn't start adding his own substantive ideas to the programming code (it has happened to me, and, I suspect, to others).

4. Interface between the computer facility (program, input-output device whether printer, CRT, remote terminal, etc.) and the simulation-gaming participant. Our primary purpose is not to teach our students computerize, but some substantive point or points embodied in the substance of the simulation-game. So we want to make the problem of interaction with the computer as simple

as possible, presumably???? Use of conversational mode time share techniques versus batch mode interaction with the computer. Other means--score sheets, porta-punch cards, etc-advantages, disadvantages.

5. Complexity and non-learning. Having a computer at hand sometimes may invite the simulation-game designer to exercise a perchant for greater complexity in model design. But after a certain point--may it sometimes be that the resultant-game becomes so complex that to the player whom we are trying to educate, the simulation-game becomes just as much a hidden black box regarding the substantive materials involved as the real-world subject--and if so, are we really furthering his educational process.

6. Questions of who shall have access to computer-based simulation-gaming. Assuming that perhaps some of our efforts might be truly useful--the reliance on a computer to operate does have the effect that some social groups in our society, who could perhaps afford to buy a book to find out about manual models and simulation-games, will be excluded by virture of their inability to access the computer.

7. Fuller utilization of the computer's power of rapid feedback to meet educational criteria of quickly reporting back to student learners on their work (a criterion we so seldom meet in the academic world????).

8. The social responsibility question. Raised at the London 1973 Advanced Study Institute on Urban Simulation and Analysis, but not answered. Ranging from who shall have access and political power distribution to questions of professional certification (should we have or not?), to possible misuse of our work by which agencies and should one refuse to work on certain contracts.

9. The role of the university and/or versus the private consulting firm in this work, access, public documentation, and questions of public policy.

10. Designing conduits for distribution to other users of simulation-games. Project CONDUIT of NSF? The Clark Rogers/Declan Kennedy computer-based information retrival concept. Some kind of international university-based clearinghouse/center (Whithed and Sarly). An archives open to scholars and govt. officials, is now being established at Polytechnic of Central London. The Peter House/EPA/ regional university dessimination of RIVER BASIN. What else???? ERIC???? Financial support for it?????

Prepared for the 12th Annual Meeting of the National Gaming Council and the 4th Annual Symposium of the International Simulation and Gaming Association Sept. 17-19, 1973

FRAME GAMES : DESIGN AND REDESIGN

R.H.R. ARMSTRONG and Margaret HOBSON

Decision Simulation Unit
Institute of Local Government Studies
University of Birmingham
Birmingham, England

(Note: these notes are intended only as a possible starting point for discussion).

1. The basic framework for any game or gaming-simulation exercise consists of:

    (a) Roles

    (b) Scenario

    (c) Accounting system

    (d) Rules and procedures

2. Games can be categorized (on one dimension) according to the emphasis accorded to each of these elements and (on another dimension) by the extent to which the representation 1 (a) and (b) accord with "reality".

3. If it is accepted that games can be viewed in terms of their components then <u>any</u> game can be regarded as merely one specific example of a "framework".

4. Thus redesign (adaptation) becomes a process of identifying the nature of the particular framework and having approximately the same emphasis (both in terms of balance between components and accord with "reality".

5. On the other hand design of a "framework" depends upon

    (a) The manner in which the individual components are defined.

    (b) The relationships established between the components. These points are illustrated in Figure I.

6. Given the minimal classification provided by Figure I various types of framework emerge dependant upon

    (a) The degree to which the rules and procedures and the accounting system are "structured"/"unstructured".

    (b) The manner in which roles and scenario are defined.

7. 6 (b) above can best be described as providing a "style".

8. If this is so 6 (a) above provides the basis for development of "frame" games. (See Figure II).

9. From the argument so far it appears that a basic approach to the design of "frame" games involves two sets of considerations:

   (a) <u>Development of structures</u> to accommodate:

      (i) conceptualisation of problems.

      (ii) basis for development of analogies.

   Abstract games provide a vital link in this process because they provide a means of:

      (i) Generalizing from existing games and gaming-simulations.

      (ii) Providing a conceptual framework into which new concept can be placed.

   (b) <u>Identification of participants and objectives</u> so that:

      (i) the degree of "structuring" required can be determined.

      (ii) the particular "style" to be adopted can be established.

ROLES

"realistic"

A. "Definitive" simulation exercises

Rules/procedures: structured or "unstructured".

Accounting system: accurate data analysis - highly structured.

Objectives:
(a) study of "system" behavior.

(b) study of decision options.

B. Gaming-Simulation

Rules/procedures: "structured" or "unstructured"

Accounting system: data analysis secondary (order of magnitude) - flexible/minimum structure.

Objectives:
(a) identify data needs

(b) study relationships Scenario

"realistic"

"symbolic"

SCENARIO

C. "Gaming-simulation

Rules/procedures:

"unstructured"

Accounting System: capability for accurate data analysis but flexible/minimum structure

Objectives:
(a) identify crucial decision-making groups.

(b) study of decision options.

D. "abstract" games

Rules/procedures: "structured" or "unstructured"

Accounting System: "structured"

Objectives:
(a) conceptualization of problems

(b) development of "analogies"

"symbolic"

Figure I

Rules/Procedures

"Structured"

A.

Participants: students

Objectives: teaching "established" knowledge

B.

Participants:
(a) students

(b) Practitioners

(c) General public

Objectives:

(a) Investigation of problem areas

(b) Communication about problem areas

Accounting system

"Structured"

"Unstructured"

C.

Participants:

(a) Practitioners

(b) General public

Objectives:

(a) Investigation of problem areas

(b) Communication about problem areas (e.g. public participation)

D.

Participants:

(a) Practitioners

(b) Researchers

Objectives:

definition of problem areas

"Unstructured"

Figure II

FACILITATOR'S STATEMENT: SOME PROPOSITIONS ABOUT THE USE OF THE POLICY NEGOTIATIONS MODEL IN THE COMMUNITY CONTEXT.

By: Earl S. Mulley
Associate Director
The Center for Simulation Studies
Saint Louis, Missouri 63105

The Center for Simulation Studies has used the Policy Negotiations model for more than four years in both academic and non-academic contexts. Out of this experience we are willing to state certain propositions about the model. The validity of the propositions for us is rooted in user observations and reflections on the experience of the game play, immediately after the play itself and after some longer time period. It is on the basis of such positive and contructive feedback that we have continued to use the model, adapting and innovating when needed to fit the needs of client groups.

Propositions:

The P.N. model is one that can be:

1. a tool to assist groups in analyzing and describing their situations both structurally and dynamically.

2. a tool for sharpening the definition of the presuppositions, character, and objectives of key interest groups in a system's decision making process.

3. an exercise in defining issue and policy alternatives, and exploring their various systemic implications.

4. a means of surfacing role perceptions and feelings of members of a group or organization.

5. a tool for testing the perceptions and data incorporated in the interest groups in the process of policy formation.

6. a device for making educated guesses about those forces outside the system that affect it.

7. a means of discovering and even experimenting with negotiating and leadership skills and style.

8. a means of creating empathy for those in another life situation by assuming their position and feeling the pressures exerted on that position by the system.

9. a tool for testing the perceptions and data incorporated in the model against the strain or tension created in the model by the game play itself. (Where there is a fit, there is a learning; and where there is not a fit, there is a learning.)

Two Caveats:

Since the people supply the context of the game out of their own experience, the simulation becomes the opportunity to sharpen and clarify, in the interaction and exchange process during and following the play, the varied perceptions of and feelings about the organization of which all the participants are a part. This process demands of the game director a broader range of skills than simple knowledge of the model. It is the conviction of the Center for Simulation Studies staff that the model is best used with a group as a part of a larger training or developmental program that has built into it those processes and skills to lead the group beyond the new insights and learnings evoked by the P.N. model.

The P.N. model should be used within its limits, i.e., not with extremely complex organizations or with groups that want to use it as an idealistic "what if" exercise.

DECISION: FUTURES MODELING

By Dennis L. Little
Long Range Administration Planning Staff
Division of Administrative Appraisal and Planning
Office of Administration
Social Security Administration
Baltimore, Maryland 21235

FACILITATOR'S STATEMENT: Within our corporate, educational, and public institutions, the emphasis on the future is increasing. The bibliography of futures publications has now reached a reported 20,000 titles. In 1971-72 academic year, over 190 educational courses, centering on the future, were offered in our institutions of higher learning. Over half of these courses were offered in education, business administration, sociology, and political sciences. The Federal government has established an Ad Hoc Interagency Committee on Futures Research. The rapid growth in federal expenditures for the "Great Society" programs-- from $1.7 billion in FY 1963 to $35.7 billion in FY 1973-- has contributed to the current federal interest in the future. People are beginning to understand that the future is not singular, not a linear extrapolation of present trends. They are beginning to see there are a multiplicity of alternative futures, some of whose occurrence we may control or influence through our current decisions. The social scientists have begun to experiment with potentially powerful new tools for probing the future. These range from complex ways of extrapolating existing trends (Delphi, envelope curves, etc.), relevance analysis, the preparation of detailed speculative scenarios, and the construction of highly intricate models, games, and simulations.

Intuitive analysis and trend extrapolation are inadequate representations of the complex reactions and interactions of the real world. Consequently many futurists have taken to mathematical modeling, gaming simulations, and games.

The directions taken have been quite diverse. As facilitator of this particular sub-group meeting, I would propose, the following points for discussion. First, why model the future. Second, a review of the state of the art in modeling the future. This might be broken down further to the work in computer simulations-- Jay Forrester's Urban Dynamics and his protegee's work The Limits to Growth probably are the best examples; the work in gaming simulations-- The Institute for the Future's Connecticut Game, STAPOL (State Policy) developed by the facilitator at the Institute for the Future, and Project PLATO are reasonable examples; and games-- Olaf Helmer and Ted Gordon's Futures Game and Helmer's Future State of the Union are examples worthy of review. A more recent style of game, where the players design the model, should also be reviewed. In games like Peru 2000 and Squatter City 2000, players design communities for the future along the same lines. Arthur Waskow, Institute for Policy Studies, has proposed "future gaming" centers which could offer experience in "living" alternative futures to people who are fed up with the present but have no feel for a workable or desirable society. Warren Ziegler, Syracuse University, Educational Policy Research Center, has done extensive work in the area of inventive planning workshops.

Third, the success and problems in modeling the future; and fourth, the future of futures modeling. On this final point, the group might wish to discuss new concepts; work in progress, or perhaps the more difficult question faced by each futurist as to whether they should be following the more technocratic approach of Forrester, Meadows, and others, or the more humanistic, "bottom-up" approach of Waskow and Ziegler. One group accepts the idea of alternative futures, but proposes to maintain control of those futures through adaptive or preventive decisions. The other group, like the first, believes in the innovativeness of man, but also that innovation is a method of inventing the future--as opposed solely to preventing or adapting to it.

In any event the future is ours. Bring your crystal balls, alternative agendas, and any papers or examples of work in this area to the sub-group meeting--Futures Modeling--Tuesday afternoon.

DESIGNING INTERACTIVE SOCIAL SIMULATIONS
FACILITATOR'S STATEMENT
GEORGEANN WILCOXSON

The Program Agency
United Presbyterian Church, U.S.A.
475 Riverside Drive, Room 1168
New York, New York 10027

SUGGESTED TASK: To identify and address the most significant present issues related to designing interactive social simulations.

PROCEDURE:

Session I

A. Brainstorm and prioritize specific issues.

B. Divide into small work groups around each issue. Each group to prepare a draft position paper on their issue.

Session II and III

Presentation, discussion and consensus seeking on each issue. The facititator will then attempt to pull together work of the entire sub-group in time for sharing at "Full task group summary meeting" on Wednesday.

SUGGESTED ISSUES (to be added to by group)

1. Values and assumptions implicit in each of the models of the design process presented during Monday panel.
2. Models of the design process additional to those presented by panel.
3. Specific techniques that help designers accomplish different aspects of the design process.
4. Definition of "interactive social simulation."

NOTE: GROUP MEMBERS ARE REQUESTED TO BRING CASSETT RECORDERS IF POSSIBLE

Sub-Group: Selecting and Developing Media
In Simulation Design

Facilitator: Charles H. Adair
Professor of Social and
Environmental Studies
College of Education
Florida State University
Tallahassee, Florida 32306

If the crucial, functioning parts of a simulation are to effect participant behavior as desired, the proper form of media must be selected or developed. At times the selection process is quite simple while at other times it is most complex. Too often the task is approached with neither a rational or a creative frame of mind, and games become merely variations of monopoly or poker. The position of this facilitating note is that the principle of alimetry is too often evident in games and simulations. Biologists have observed that living forms constrain the functions of those forms. If a bumble bee were to become the size of a man, his respiratory system would have to take in and discharge air with the force and volume of a jet engine. So too, when we choose to represent newly born babies with poker chips, the functions of a game are restricted.

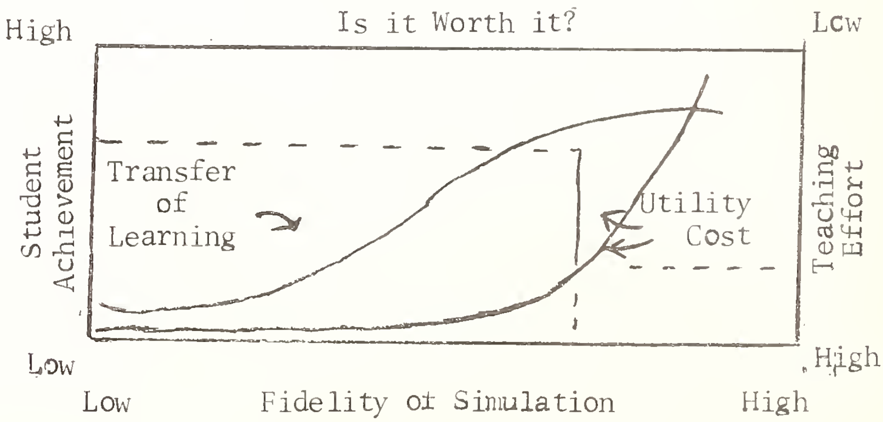
Just how functional need our media be? That depends on at least three possibilities.

1. <u>How realistic must be our media?</u>

   This depends on the model of reality the designed has in mind. Fidelity in a simulation is not always important.

2. <u>How much can one afford to invest in media?</u>

   This depends on its utility which is determined by the marginal performance of students and the anticipated use of the simulation. A model helps here.



3. How can we be creative in generating media selection ideas?

This is aided by asking of ourselves, "Do I want cognitive clarity in the main, or is rich-impressionistic experience to be preferred?" Does this function rely most on cognitive, social ego or visceral motivation?" "Will symbolic, ikonic or enactive modes of participation be appropriate?"

STUDENT DESIGNED GAMES

FACILITATOR'S STATEMENT:

HARRIET TAMMINGA
Department of Sociology
University of Denver
Denver, Colorado 80210

I'm sure that there are easier ways to teach than by having students try to design a gamed simulation- giving a lecture isn't too hard if one is reasonably articulate and this can be further simplified by carefully filing old lecture notes to be revived at the appropriate point in the following semester. Of course, a conscientious instructor might occasionally entertain a few doubts about the effectiveness of this "teaching" method, particularly if he is actually concerned with "learning". Instructors who insist on making it more difficult for themselves by using the teaching method of having students design games haven't proved, however, that this educational technique ensures more or better learning. But those who have seen the heightened interest and apparent increased understanding of subject matter of the students who have been involved in the game design process usually seem to feel that the extra time and effort expended were justified. (Perhaps this is a phenomena similar to that often reported regarding simulation participants; just think of the cognitive dissonance if they had to admit that their time and effort had been wasted!)

It is difficult to make generalizations about what is learned through the game design process since the educational goals for various disciplines differ. In addition, the terms "game" or "simulation" or some combination of these are applied to a variety of things which different instructors may view as the desireable end product of the design process. There are different levels of abstraction which can be represented by a game: from a simplified replication of actual events or role-playing, somewhat akin to a description of an occurence, ranging to complex simulations of analytical models, which are more like explanations of some real world phenomena. In teaching sociology, I've been concerned with having students design gamed simulations which involve grasping the underlying conceptual model. (c.f., Barton or Twelker, who refer to the relationship between the real world phenomena, the conceptual model, and the simulation.) Although it is possible to use an existing model, it is often necessary to help the students develop an analytical model before they can visualize the gamed representation of it. Students often find it hard to shift levels of abstraction in order to identify patterns or relationships in events in terms of the conceptual model, instead of focusing only on the level of the immediate referent situation or tangible game elements. Not all students are ready or willing to work to get this understanding, but game design offers the possibility to those who are.

"Computer-Based Gaming Models"

Philip D. Patterson
Environmental Protection Agency
Washington, D. C. 20015

The use of computers as part of the operation of games began early with the military. Early use of the computer in non-military gaming activities is also evidenced by the Internation Simulation (Harold Guetzkow, 1966), Carnegie Tech Management Game (Peter Winters, etc., 1964), International Operations Simulation (Thorelli and Graves, 1964).

The rich history of both the design and use of manual and computer urban games provides a good backdrop for discussing 1) the reasons for designing and using a computer-based game, 2) the ways in which the computer is used by the designer and the player, and 3) the experiences gained by both designers and users of computer-based urban games.

The following outline represents a possible starting point for a discussion of computer-based gaming models using urban games as the illustrative example. An indication is made as to which person(s)-designer, user (instructor or leader), and/or player benefits from the computer assist.

I. Reasons for Using the Computer

A. Allow for Complexity (designer)
B. Communication (player, user)
C. Deal with Complexity (player, user)
D. Provide Discipline for Inputs (user)
E. Provide Accuracy for Outputs (user, player)

II. Ways Computer Is Used

A. Bookkeeping (user, player)
B. Quick Feedback (designer, user, player)
C. Simulation of Outside Forces (designer, user)
D. Simulation of Internal Market Operations (designer, user)
E. Flexible (location or time of day) Input from Teletypes (user, player)

III. Experiences with Computer-Based Urban Games

A. Cost of Design and Debug (designer, user)
B. Cost of Use (user, player)
C. Achievement of Realism (designer, user)
D. Dissemination
   1. Computer compatibility
   2. Language transfer
   3. Facilities required
   4. Documentation of Model
   5. User's Guide
   6. Player's Manual

Several examples of urban gaming models will illustrate why computers have been spurned by some designers and used by others.

First it is clear that some urban gaming models would probably lose their dynamics and thus be harmed by computerizing them. SIMSOC and SITTE are two examples of this class. For example, SIMSOC allows for a lot of horse trading among the players as they hire one another, travel from one region to another, etc. Any need to rely upon a computer would only hamper the actions of the players.

Second, there are some relatively simple games that can be played manually, but ease of play (particularly if many cycles of play are contemplated) can be achieved if a computer version is used in which the computer performs a bookkeeping function. Examples of this class are the CLUG, METROPOLIS, and NEW TOWN games that are available in both manual and computer versions. For example, CLUG is an easy game to play manually during the first few rounds when one starts play with a blank board. By the time twenty parcels of land or more are developed, however, the annually payments made by the players for salaries, goods, and transportation become so burdensome that a computer provides welcomed bookkeeping assistance.

The computerized CLUG and METROPOLIS games were expanded, respectively, by the CITY series and the METRO-APEX gaming models. The CITY models added computer simulations for urban functions such as migration, housing, employment, transportation, and shopping. METRO-APEX added computer simulations for migration, housing, exogenous and most endogenous activity, and voting. These models, along with GSPIA and several others, used the computer for both bookkeeping and computer simulation.

A recent development in urban gaming models emphasizes the use of the computer as a communication device and simplified bookkeeper more than as a simulator. Examples of these games are TELECLUG, BUILD, and ACRES. For example, ACRES as played at Dartmouth is run in such a fashion that players may input decisions at any time prior to the time the instructor has specified as the end of the round. This could be several hours or several days after the start of the round. Furthermore, the players may use any of the many teletypes around the campus for making their inputs.

A recent and still small portion of urban games are those that have grown out of mathematical simulations. Forrester's Urban Dynamics model has served as such a starting point for an urban game and others are likely to follow suit.

The game designer who is contemplating the design of a computer-based game should realize that a synthesis of game design techniques and computer-modeling techniques will probably be required. A hybrid technique is called for, and one should not overlook the experiences that others have gained in searching for this technique.

UNSTRUCTURED AND GAME-GENERATING GAMES
FACILITATOR'S STATEMENT:

'Unstructured and game-generating games' are actually structured, but they are mostly less pre-structured than conventional simulation games. Therefore I would like to suggest to substitute the term 'unstructured games' by:

- Minimal structured games
- or - Non-specified games
- or - Skeleton games
- or - Heuristic games
- or - Frame games (see: Sub-Group: Frame games: design and redesign)

If - however - the concept of unstructured games is generally accepted, I would argue in terms of information theory that messages which do not show any structure (manner of organisation of elements) do not contain any information. Accordingly an unstructured game is a non-game: What is called an unstructured game does not mean anything to any observer.... What do you think about it?

'Minimal structured and game-generating games' might be defined as games which provide a framework within which the game-participants specify the content of the game. Emphasis of the players' activities is laid on designing - not only on playing the game.

To clarify this let us arrange social and simulation games on a continuum with the extremes 'rigidly structured games' (rules determined) and 'unstructured games' (rules not predictable). To give some examples: Chess and Metropolis (Duke) tend towards the extreme of rigidly structured games, GRIPS (Warshaw et.al.) and SCENARIO (Dette) tend towards the extreme of unstructured games. Refering to the last two approaches it can be said that both contain a set of rules i.e. a sort of structure - but, deviating from the first two approaches, their field of application is not pre-defined and the direction of the arguements in the game is neither predictable nor following any probability distribution.

The crucial question in the design of 'Minimal structured and game-generating games' - actually concerning all games - is the question of validity: "What is a game of this category good for?"

Without restriction I only would say that each assessment of the validity of a game is a short-lived one: A game which has been proved invalid to serve one defined purpose might be valid to serve another important purpose not yet discovered - or - a game which seems to be valid at one point of time becomes invalid the next one, when it can be fully replaced by a 'better' game, or something else.

So far as my practical experiences with 'Minimal structured and game-generating games' are concerned, they are mainly based on the development and test of the SCENARIO-GAME at English and German universities.

To give you a brief outline of this approach, let me quote the comment from one of the game-participants:

> "1) Each move in the game takes on a ritual-like aspect. The purposes of these 'rituals' appear to be to allow those involved to leave behind normal responses and possibly - although not necessarily - be open to new or unusual responses.
>
> 2) The game is highly dependent on user participation: you get what you put into it. I would imagine that mental blockages against fantasy become quite functional.
>
> 3) It offers some advantages of encounter sessions without the raw exposition of personal hang-ups. One's feelings are exposed through one's attempt at abstract intelligence.
>
> 4) As with everything that allows for spontaneity, there seems to be no guarantee of success: only the players can do that, with their attitude.
>
> 5) I can see the game being used as a means of introducing new students ("oh yea, she was the one who played the role of 'french tickler' in the game") with an exchange of goals, emphasis and desires."

Comments like these on a game are certainly encourageing the game-designer to present the game again - and they may stimulate potential players to play it. But, do they validate the approach according to scientific standards if only the percentage is high enough?

The number of times a game is played and the number of kits which have been sold do they validate a game, or are other variables - perhaps image or influence of the game-designer - responsible for the height of these numbers?

Or, are there generally accepted ways to measure the validity of games, where the human imagination and the potential to design own thoughts are the main factors?

KLAUS F. DETTE

Lehrstuhl fuer Stadt- und Regionalplanung
Technische Universitaet Berlin
1 Berlin-West 12
Strasse des 17.Juni 135
GERMANY

FORMAL PAPERS

A Process for Designing, Developing and Evaluating Social Simulation

Charles H. Adair
Professor of Environmental and
Social Studies Education
Curriculum Design and Personnel
Development Program
College of Education
The Florida State University
Tallahassee, Florida
32306

A paper presented in the panel, "Models of the Gaming-Simulation Design Process" 12th Annual Symposium of the National Gaming Council and 4th Annual Conference of the International Simulation and Gaming Association.

Introduction

Simulation design, beyond all doubt, is a dynamic process. The explication of the process model or system developed at Florida State University over the last five years was made possible by repeated experience in applying it in a graduate course, "Simulation and the Social Studies - SOE 523," and the contributions of many students and colleagues.[1]

Novice designers vary greatly in their knowledge of form and function, the selecting of media and evaluating a prototype they have developed. Crudely and haltingly the following structure has emerged as means for shaping a first experience.

Figure I

- General Introduction
  - Models and Theories
    - Pedogogical Models
      - Simulation Media
        - Prototype assembly
          - Developing an Evaluation Strategy
            - Observation
              - Field Testing
                - Analyzing Data
                  - Improving the Simulation

Getting The Designer Started

Most often, those who would develop a simulation have an idea or image in mind. It may be characterized as a novel arrangement in which participants could learn about some general topic of interest. A wild life ecologist, for example, wishes to manipulate uninterested adults into a new posture of great concern for selected endangered wild life species. To develop a working vocabulary and to conceptualize the function of the condition to be simulated is a first necessity. The eager designer wants to move immediately to developing the form of prototype itself and some selected experience is necessary. The total design process, we have introduced by means of an inhouse video tape recording. Some early discussion around Hon Raser's Simulation and Society,[2] Sarone Boocock's and E.O. Childs' Simulation Games and Learning[3] and the particular interests of the designer-to-be are quite helpful. A few exercizes in which the concepts of congruence, abstraction, fidelity, utility, isomorphism and learning transfer are manipulated stand as operations of value depending on the background of the beginner. Those who need it are taught to flow chart quite simple functions Several piecemeal and skeletal simulations are played and analyzed, with the concepts in mind.

Since the design process in viewed as a research and development activity a task of defining the problem always exists. Students are asked to write a "position paper" in which they review an array of systematic explanations of the problems they have defined. Essentially, they must arrive at a precise definition of a current state of affairs and a preferred state of affairs before selecting or developing a theoretical explanation of means of getting from one to the other. The "means" is in itself an explanatory system. In the case of a wild life ecologist it was crucial to determine which species were to be included, the means of determining how they are valued and understood by the target population, generating an indexing procedure, selecting a theoretical rationale for developing values and a means for value clarification. This is a new, demanding learning experience which supports the Raser assertion that simulation design is in itself a unique theory building activity.

Students and practitioners in the social science disciplines and applied fields, e.g. nursing, social welfare, law, education, etc., usually are poorly trained in theory. They have real difficulty in conceptualizing due possibly to long experience in simply describing rather than explaining social phenomena. They need considerable help, and it is worth it.

Once students have a clear idea of the components and the syntax of the components to structure their simulation the matter of social and human dynamics presents itself. I have found James S. Coleman's "Social Processes and Social Simulation Games" in the Boocock and Childs text to be most valuable reading. Each fledgeling designer presents "his model" and the whole design group interacts around it by applying the Coleman ideas of a social environment, procedural rules, mediation rules, behavior constraints, goals and means of achievement, environmental response rules and police rules. See Figure Two (attached). This operation has the effect of forcing the designer to specify the functional behavior of simulation participants and the means for achieving it.

Quite often the explication of a conceptual model as being dynamic is the real breakthrough in understanding social simulation. Symbolic words are no longer confused with real behavior. Also the number of rules and expected entry skills of participants is reduced considerably. Inbarr and Stoll have presented many case studies of important designers that had to learn this the hard way.[4]

Sophisticated student designers at this point are urged to read Herbert Simon's, The Sciences of the Artificial.[5] It may be noted also that advanced students begin to view their efforts, at about this stage, as being the stuff of a good doctoral dissertation study. When this is the case Hill and Kerber's excellent test on education research design and analysis is suggested along with reading the later segments of the Guide For Simulation Design.

Building the Simulation Prototype

Once the theoretical model has been operationalized in a flow chart format the tasks of media selection arises. Each function in the flow chart is examined with the use of a Media Selection Model presented in another paper at this meeting. (See Figure III). The designer poses a series of questions for each function.

1. Do I want clear, cognitive meaning or rich impressionistic experience in this function?

2. What is the best representative mode to employ: symbolic, ikonic or inactive?

3. What kind of motivation is appropriate here: congnitive, socio-ego or visceral?

4. How will learning take place in this function: verbally, vicariously through objects and inferences or by direct experience?

5. Given the answers to 1-4 what is the optimum medium: Printed Materials through Direct Real Experience?

This process again is a demanding intellectual exercize that helps but does not solve the problem of media selection or development. If two media seem to be equally appropriate the one incurring the least development cost is suggested. In the case of absolute "hang ups" students are encouraged to "mess around" with a wide variety of objects, colors, swells, surfaces, shapes and sounds. What doesn't result analytically at once will be produced intuitively in time.

An aspect of the media selection process is the basic development of specialized materials. Case studies, critical incident series, special purpose map projections, cartoons and other materials call for special development skills. When students possess them all is well; otherwise, they must develop the skill or contract the services of others to help.

To put it all together, to assemble the prototype, like the actual media development itself, is aided by the early efforts to conceptualize clearly. The flow chart suggests the proper sequence and arrangements.

A double purpose is satisfied by the development of a handbook for instructors or others who would monitor the simulation. The designer must view the prototype as consumers would see it. After the experiences described to this point the designer finds difficult the realization of how much he is a part of the simulation. To work properly for others the simulation must be free of designer assistance during its operation. Of course this is discovered in field testing, but that is rather late in the game.

A participant's manual is prepared, usually rather poorly. Field testing seems to be the only way to cause designers to reduce the volume of initial instructions and to include crucial information here-to-fore unanticipated.

Evaluating the Simulation

The very complex nature of social and human behavior found in simulated activities has rarely been evaluated powerfully. We have been helped considerably by Michail Scriven's, "The Methodology of Evaluation"[7] wherein he views both products and processes. Conventional pre-post testing within an experimental design has merit, yet more is needed by the designer; he must observe the internal mechanisms in a formative way.[8] To facilitate matters the designer is asked to study his flow chart and enter the media selected for each function. He draws another flow chart to the same proportions, omits the notation and has a "skeleton" of what he wishes to observe. Next he employs a "Schema For Analyzing Social Simulations" to specify the diagnostic, formative and summative attributes which are essential to meet the general criteria of isomorphism and "playability." For example the entry characteristics of participants, the needed skills, knowledge, attitudes and despositions are specified. "Does one need to know the range of a Florida crocadile in salt and fresh water to comprehend a particular critical incident?" asks the wildlife ecologist. In answering such questions designers develop a Simulation Evaluation Strategy.

The simulation has processes that are crucial to overall success. Most evaluators attempt to observe these with testimonial-like questions of participants after the action is completed. But this lacks varacity and discreteness. We attempt to examine the internal, functional and substantive replications of the theorectical model. This is facilitated by raising the question of the desirability of divergent or convergent learning behavior and using those concepts of Raser and Coleman noted above. We have found that this operation is most valuable in making the first data from "tryouts" of the simulation truly informative for the designer.

The more conventional aspects of evaluation are treated in two summative dimensions: performance expectations and valuational expectations. The first are observable and measurable cognitive behaviors capable of being recorded at the termination of the simulation activity. They may also be observed during the operation of a simulation to render evidence which would logically explain some failure at the end. The establishment of preset, anticipated outcomes occuring due to defined stimuli which pertain to specific goals or sets of goals are recorded and can be compared experimentally.

Valuational expectations are those ad hoc, indirectly measurable, crudely observable factors of motivation that affect the participation in a simulation. The concept is used by Lawrence Halprin who described "creative processes in the human environment."[9] More specifically the heavily researched variables of interest satisfaction, cognitive growth, achievement motivation and coping are considered.

Since most of those who have gone through this experience have had little or no training in observation some time is spent on the subject at this point. Reflecting on Durkheim's The Rules of Sociological Method, John Madge's The Tools of the Social Sciences, Harold Larrabbee's Reliable Knowledge, Simon and Bayer's Mirrors for Behavior and Carlo Lastrucci's, The Scientific Approach is quite useful for serious students of observation. Yet for most beginners a series of suggested activities are employed. From this effort and a visceral "need to know" the designer carefully develops a Field Tester's Guide. He "trys it out" to insure that all important data is included and redundancy is avoided. This little tool to formulate the feedback from others who test the simulation has not been very successful. Probably the fatigue, personal cost and lack of adequate reward to the designer is the cause.

Field Testing

To observe actual performance of subjects is a crucial matter in simulation design. Most often the simulation is "tried out" in dormatories, homes and local bistros. The gross operational weaknesses of the prototype are revealed this way. Next "try outs" are arranged for the target population and the designer must contact the appropriate source. Family planning clinics, jails, school classes, garden clubs and graduate seminars are examples. The designer tests not only the prototype itself but also the data collection procedures, the Student Manual, the Instructor's Manual and the Field Tester's Guide. The preliminary results are given what may be called a serious but general examination. The data is "eyeballed."

Field testing at the outset helps the designer-evaluator to generate emperical hypothesis to be tested later as scientific hypothesis. For example it was found in testing nursing and social welfare undergrad majors that the game Obstacle Course really didn't produce much in the way of cognitive gains regardless of the compliments of professors and student players. Yet the very same game produces significant cognitive gains among inservice public health nurses and social welfare professionals who are working in family planning clinics. The first case conforms to the experimental findings common to our literature, yet the second does not. A question arises: If it is assumed that students in school are accustomed to learning by convergent means and that practitioners in real vocational situations are accustomed to learning more divergently through their experience, is it not best to simply have students study conventionally and practitioners learn through experience in simulations? Obviously many theoretical insights can be brought to bear in setting up an experiment. The point of the illustration is that field testing has more than practical payoffs for serious students of simulation design.

Experience has suggested that early field tests should include a preliminary experience followed immediately by another experience in the simulation. The first effort by participants is awkward and usually familiarizes them with the goals, media, rules and restraints. The second allows the designer to make fruitful observations.

After prototype modifications have been made due to early field test results the well designed experiment is in order. This may be asserted because a proper theoretical foundation has been layed and the treatment reliability is much less in question. The costly and demanding effort of controlled evaluation through experimentation can take place legitimately.

Analyzing the Data

Efforts at Florida State University to date suggest the following guidelines:

1. In comparative studies which test simulations, it is most often true that one doesn't have matched samples, so some analysis of covariance technique may be used to insure equivancy of groups.

2. If the simulation is run with the same students more than once, a carry-over effect exists, so one should compare post test results after each trement rather than the differences between pre-post test results.

3. It is very often true that one is interested in the comparison of average performance but individual performance too, so a concern for the distributions and correlations should be included in the study.

4. Analysis of variance, covariance and other statistical techniques, particularly if done on a computer, demand assumptions about the population, sample, continuity of responses, format of data for analysis, etc., that suggests very careful and early planning.

5. Very often simulations, when used as treatments, allow us to make observations of participant behavior in a (molecular) part of the total set of simulated events. It is crucial to consider the postdictive and predictive nature of events surrounding the event to observe properly in such cases.

6. Since many games involve scores that may be used as success-failure criteria one is confronted with the problem of using criterion reference measures. Nonparametric comparative techniques are frequently the solution for analysis.

Modification and Improvement

All of us who test carefully our simulations find great moments of exhilaration and depression. The modification of a component, rule or condition that has been generated by hard work isn't accepted readily by a designer. His intellect and creativity are challenged. Yet so it must be.

Quite often the tested protype needs more sophisticated media to achieve its designer's intents. And this is costly, another real problem, the solution of which usually wil have to come from funds supplied by government programs or business firms that wish to use the simulation.

Summary

This review of a simulation design process has attempted to stipulate in a somewhat linear manner the components and sequence of operations which have proven appropriate and useful at the Florida State University. In fact, much that happens has a hueristic quality that makes this model stochastic at best. So it is with most efforts to link theory and practice in creative efforts.

References

1. Charles H. Adair and John T. Foster, Jr., A Guide For Simulation Design, Instructional Simulation Design, Inc., P.O. Box 3330, Leon Station, Tallahassee, Florida, 32303, 1972.

2. John R. Raser, Simulation and Society, Allyn and Bacon, Boston, 1969.

3. Sarane S. Boocock and E.O. Childs, Simulation Games and Learning, SAEE Publications, Beverly Hills, California 1968.

4. Michael Inbar and Clarice Stoll, Simulation and Gaming In Social Science, The Free Press, New York, N.Y., 1972.

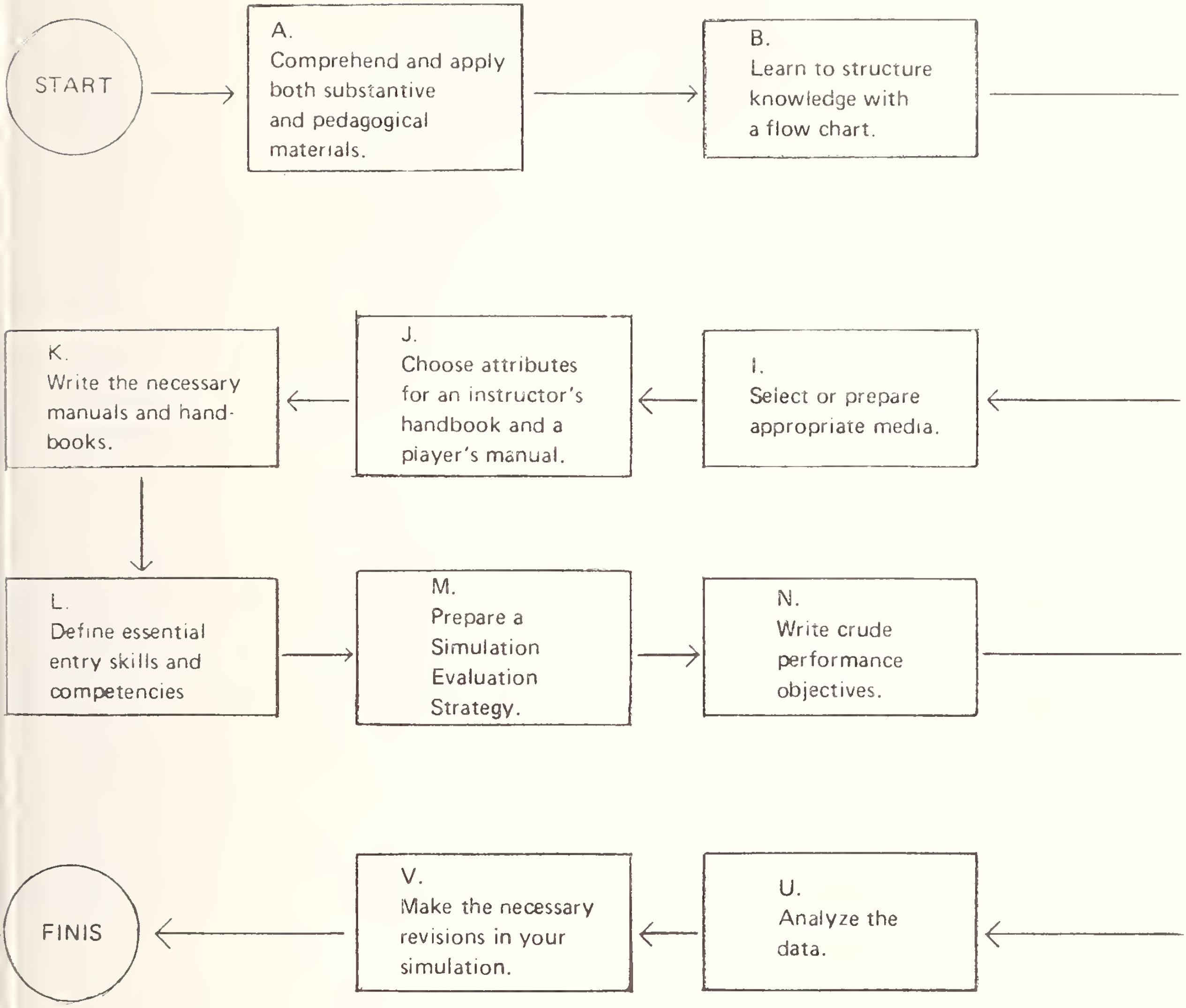
5. Herbert A. Simon, The Sciences of the Artificial, M.I.T. Press, Cambridge Massachusetts, 1969.

6. Joseph E. Hill and August Verber, Models, Methods and Analytical Procedures in Educational Research, Wayne State University Press, Detroit, Michigan, 1967.

7. Michael Scriven, "The Methodology of Evaluation," Publication No. 10, Social Science Education Consortium, University of Colorado, Boulder, Colorado.

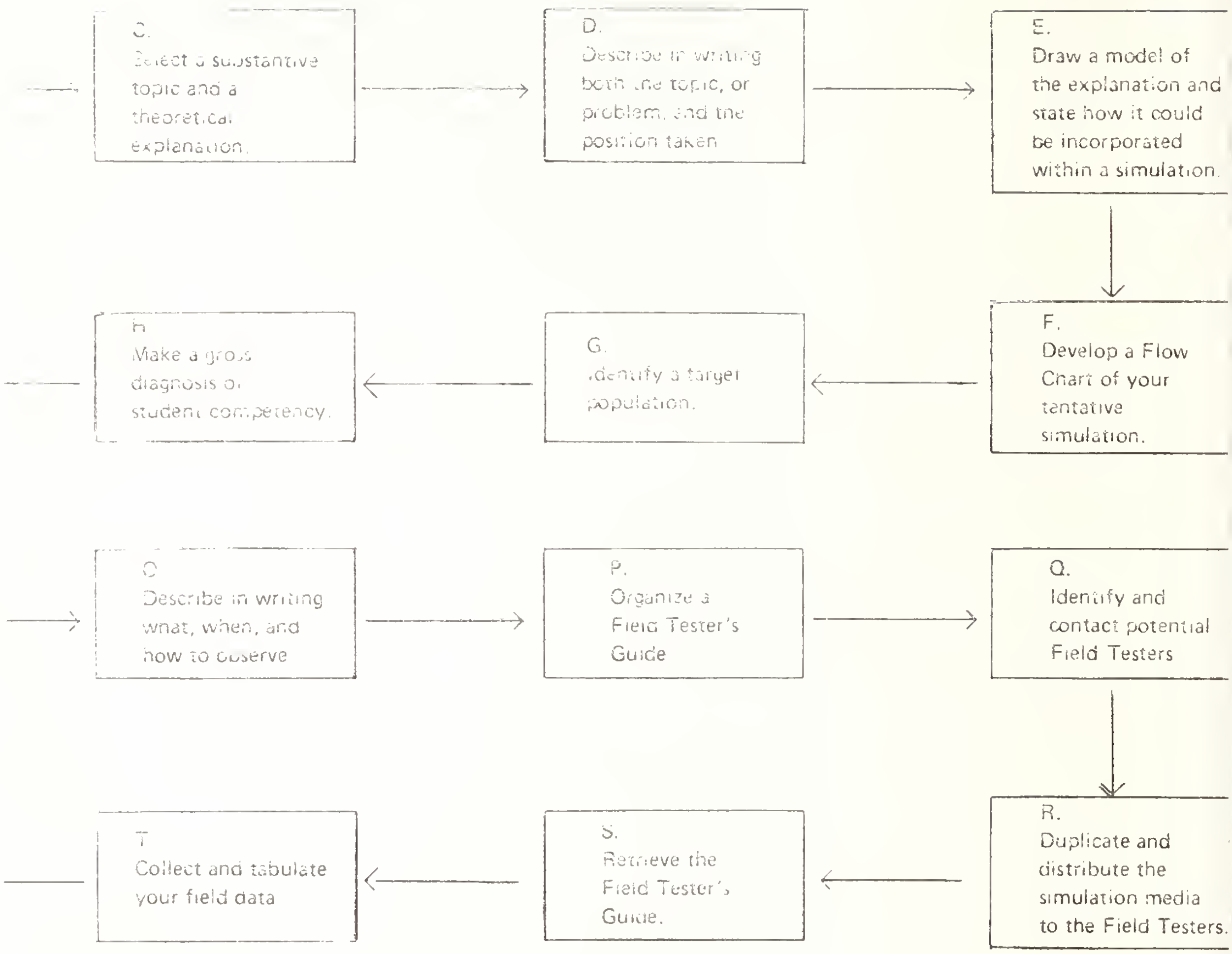
8. Gene V. Glass, "The Growth of Evaluation Methodology," Monograph No. 22, Laboratory of Educational Research, University of Colorado, Boulder, Colorado.

9. Lawrence Halprin, The RSVP Cycles: Creative Processes In the Human Environment, George Braziller, Inc., New York, N.Y. 1969.



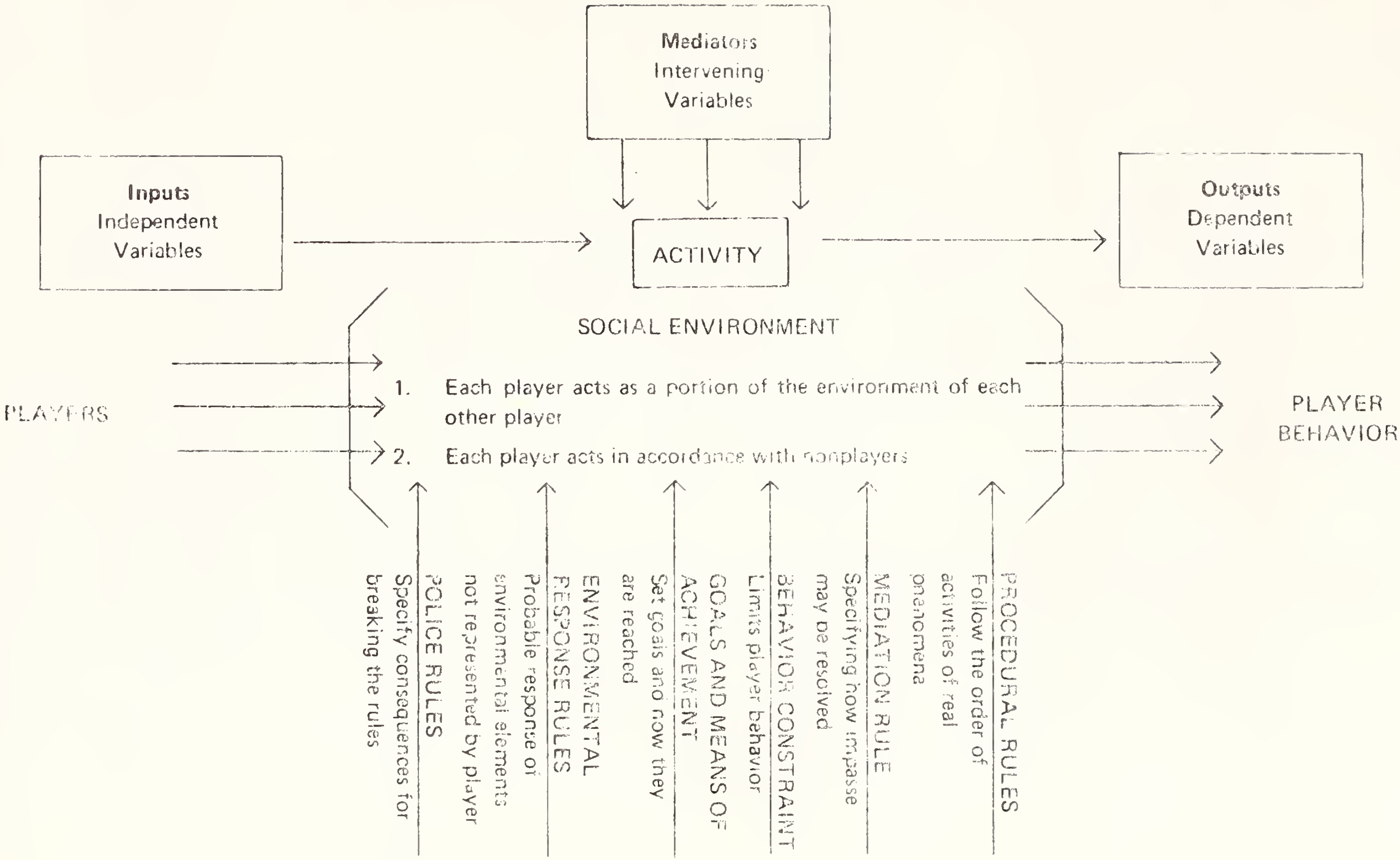
Flow Chart I

An Overview to Simulation Planning and Building.


C.
Select a substantive topic and a theoretical explanation.
D.
Describe in writing both the topic, or problem, and the position taken
E.
Draw a model of the explanation and state how it could be incorporated within a simulation.
F.
Develop a Flow Chart of your tentative simulation.
G.
Identify a target population.
H.
Make a gross diagnosis of student competency.
O.
Describe in writing what, when, and how to observe
P.
Organize a Field Tester's Guide
Q.
Identify and contact potential Field Testers
R.
Duplicate and distribute the simulation media to the Field Testers.
S.
Retrieve the Field Tester's Guide.
T.
Collect and tabulate your field data

A MODEL

developed from James S. Coleman, "Social Processes and Social Simulation Games," *Simulation Games and Learning,* (Sage Publications: Beverly Hills, Calif.) 1968, Sarane S. Boocock and E. O. Child (eds)



MEDIA SELECTION MODEL

	Representative Mode	Message Considerations		Learning Considerations	Optimum Media
CLEAR COGNITIVE MEANING	**Symbolic** This mode requires high order cognition and a correct knowledge of symbolized information. Through the medium of information processing, retrieving, inferring, and synthesizing learning can take place. Dispositions and values attached to the symbols shape perception. Learning is dependent on and a product of cognitive ability, cognitive motivation and selective perception.	Cognitive Motivation	Structured, Limited Information—Experience	Verbal Learning	Printed Materials Direct Oral Communication Oral Readings
	Ikonic This mode requires the ability to infer by association, the nature of some phenomena in terms of objects and realia. Through the medium of observation, categorization, association and extrapolation learning can take place. and values determine the level of interest or concern the learner may have. This level of interest, in turn, becomes a mediator of the impact of the media on the learner.	Socio-Ego Motivation		Object—Vicarious Learning Social Learning Through Inference	Still Pictures Motion Pictures Observing Prepared VTR's Socio-Drama Psycho-Drama Structured Panel Discussions Use of Artifacts & Physical Models Exhibits
UNCLEAR COGNITIVE MEANING	**Enactive** This mode requires inquiry behavior that, through a positive reward system, can lead to habitual behavior. Through the medium of actual, at times physical, manipulation of information sources the senses are employed to learn in a heuristic manner. Repetitive experience will strengthen interest and a propensity to inquire.	Visceral Motivation	Unstructured, Rich Information—Experience	Direct Social Stimuli	Personal Participation in Argumentation Recording Self on Audio Tape Recording Self on Video Tape Contrived Experience Direct Personal Experience

1. Do you want clear cognitive meaning to result from the simulated experience?
2. Choose a representative mode that is most appropriate.
3. Consider motivational, experiential and learning attributes of the activity to be simulated.
4. Choose the optimum medium for the teaching-learning function.
5. If you can't choose from several equally acceptable media, which incurs the least cost to you?

A MODEL FOR SELECTING OPTIMUM MEDIA AS PART OF THE SIMULATION DESIGN PROCESS *

Charles H. Adair
Professor of Environmental and
Social Studies Education
Curriculum Design and Personnel
Development Program
College of Education
The Florida State University
Tallahassee, Florida
32306

Introduction

To present a model for selecting media in simulation design requires a few definitional notes, a general framework for the activity and some rather specific descriptive constructs to reveal the model components, their interrelationships and the necessity for each. This paper will attempt to reveal a process that has been employed over the last three years at the Florida State University and has been included as part of a basic Guide For Simulation Design.

Simulated learning activities possess the potential for being a major breakthrough in the teaching-learning process. Possessing the long sought quality of bringing reality to learning encounters, they have the advantage of high validity, independent of the typical problems of misuse in the classroom such as we see with textbooks. As John Raser notes, "simulation is a dynamic model" which contibutes to even more than participant learning - to theory development itself.

For those of us designing simulations and training designers the awful truth of Abraham Kaplan's appraisal of models presents itself. He notes that by their nature basic structures are revealed with strengths and weaknesses being apparent. Theories, like well written essays, tend to seduce the casual observer but in the case of models, the cards are on the table. Everything is exposed.

Our products reveal themselves for brutal, penetrating criticism of isomorphic structure, effective behavioral determinants/modifiers and clear results in terms of specified operational objectives. To create a synthesis of all of these components requires the selection and development of media appropriate to each. This is a problem malaxation which is far from solved theoretically.

---

*A paper presented in the Task Group on Design as part of the 1973 meeting of the National Gaming Council and the Fourth Annual Symposium of the International Simulation and Gaming Association.

Some particularly superior thoughts on optimism media selection have been advanced by Rand Corporation scholars, educational systems designers like Professor Leslie Briggs and a host of specialists in educational technology audio-visual education and communication. Yet the principles and generaliz tions from these sources have not seemed to possess the practicality and im mediate applicability needed by designers. Over many experiences, both fru trating and rewarding, a crude system has emerged at FSU and the purpose of this short paper is to describe and explain the Model for Selecting Optimum Media in simulation design.

Observing the basic design dictum that form should follow function the crea of a simulation must start with a model of the functions he wishes to repli cate. I have found that the process of reducing general models to operatio terms by flow charting has aided us in specifying the conceptual and syntac structure of the simulation to be. Once this is accomplished the selection of media appropriate to rather specific operations is facilitated.

Each of the functions of the simulation has its own media requirements depe ing on the operation of participants at that point, the behavioral constrai and rules prevailing throughout the simulation and particular inputs from antecedent operations. With these elements ascertained and specified it is possible to employ the model (Addendum I) in selecting and developing the instrumental materials.

This model suggests a process that may be described in schematic form (See Addendum II). By using terminal symbols (circles), function symbols (rectangles), and decision symbols (diamonds) the conceptual components are spe fied. The use of connecting arrows reveals the syntactical order of the co ponents and the need for feedback and feedforward (loops) relationships.

A form more familiar to many beginning designers is a description of the model components, step by step, juxtaposed by an explanation for the necessity for each step.

Steps In Selecting Media

step #1 Take the general model, which structures the knowledge components for your simulation, and compare it with your flow chart. If you have failed to include any of the parts of the model, ask yourself "Is this omitted on purpose or by oversight?" Make any changes in your flow chart that you deem necessary of these steps.

> The matter of reliable knowledge is at stake in step #1 and one must insure adequate isomorphism between the knowledge deemed essential and the structure (conceptual and syntactical of the simulation. This step insures a special rechecking of the epistological quality of the simulation and your judgement based on the criteria essential to the application of your mod

step #2 Now that your flow chart squares with your conceptual model and you know what each part of the flow chart is to accomplish you may begin to apply the Media Selection Model. The first few times that you do this should involve going through the steps that follow very systematically. Yet, as you catch on to the system only the model in front of you need be considered.

To comprehend a complex process one must develop an internalized logic in performing it. Once this internalized logic exists in the simulator, speedy utilization is permitted.

step #3 As you examine the flow chart function (box, diamond, or circle) and reflect on what it is to accomplish, decide on the learning characteristics implied. You will have to note:

		Storage	
Encounter	Intake	Control	Motivation
		Action	(after Suchman)

a. What kinds of information does a target individual possess?
b. If he doesn't have it - how can you give it to him?
c. If he does have it - how can he retrieve it?
d. What type of motivation is best here?
e. What control must the simulation have over activities?
f. What action do you want to have as a result?

If you can answer these questions, choose between one of the three representative modes:

Symbolic: Best for experienced, sophisticated participants. Most efficient if not changing (Ex.: reality of values and transferring simple ideas. Book)

Iconic: Usually valuable for all participants. Must be selected with artful, skillful effort. (Ex.: good for quick identification. Picture).

Enactive: Best for inexperienced, naive participants. Crucial for teaching reality and for changing values. Critical for decision making. (Ex.: Role Playing)

While it is generally helpful to distinguish between Symbolic, Iconic, and Enactive modes of representation, very little is accomplished without identifying the operational characteristics, in terms of the teaching learning tasks, of each mode. Suchman's model (above) helps to determine whether the target population must gain new information or retrieve what is already known. What the immediate motive will be is a function of the urgency imposed by the simulation and the characteristics of the subject. Action will result in terms of these factors as well as the kind of controls, induced by the simulation, in processing the information. The simulator's choice of one of the three is a somewhat heuristic process of selecting modes in terms of his means-ends desires.

step #4 Now that you have chosen a representative mode, consider the kinds of media available for that mode. This will be found on the right hand side of the Media Selection Model.

a. Select a type of media.
b. If you are stuck with two or more equally good media - ask yourself which has the greatest liabilities in terms of cost, availability, convenience, etc.

As the simulator, committed to a representative mode, attempts to choose from a number of rather specific media types, his concern is to pick one that will optimize the particular learning for a particular kind of subject. When faced with the task of choosing between media equal in terms of validity, reality or attitudinal conditions, the simulator can make his decisio on the basis of negative considerations such as, cost, convenience, time, etc. This is, as in step #3, a heuristic means-ends strategy that becomes easier with practice and experience.

step #5 Imagine the particular form that the type of medium selected should take in your simulation. Write your decision into the (box, diamond, or circle) function in your flow chart.

Recording choices on the flow chart serves the practical need for keeping track of decisions. Also, it once again causes a reflectioi on the priority system for selection based on the amount of validit; reality, or awareness critical for participants performing the func· tion.

step #6 Proceed to the next function in your flow chart and, by going throu; the steps 2-5, decide on the medium.

This step is one of getting the next selection task accomplished and reinforcing the system in the mind of the simulator. Depending on the aptitude of the simulator a point will be reached in which he simply may look at the model and he will rapidly progress through the system without tediously or consciously attending to the steps.

step #7 When you have selected the media for all of the functions in your flow chart:
a. Consider how often they repeat themselves. Does this suggest anything to you?
b. Can you simplify the job of getting the media or developing it yourself by making any adjustments in your decision?

The writer upon completing the several discrete media selection tasks in the simulation, must view the whole. As an aggregate it must possess some continuity and parsimony or be much too complicated to construct or utilize. This closure point is critical for both efficiency and subsequent action.

step #8 Procure or develop the media now.

To do the actual procuring and developing is important at this point as there are usually many loose ends and sometimes judgment errors in the process of selection. Tactual learning, novelty and awkwardness in action are all structural-functional considerations that come into play as the materials are selected, shaped, and organized for the prototype simulation.

Conclusion

To present a systematic procedure for selecting media is not to select the media itself. At times a knowledge of botany will simply not get a flower to grow in a crannied wall. It is at that point designers are urged to use all of their senses, intuitions, fleeting hunches and bits of creativity to perform the task. After considerable smelling, feeling, tasting, staring, listening and talking about the function in the simulation something can happen. And with luck aided by reflective effort the decision is made. For the designer the next encounter is one of trying out the operation and later testing formally.

Bibliography

Charles H. Adair and John T. Foster, Jr., Guide for Simulation Design, Instructional Simulation Design, Inc. P.O. Box 3330, Leon Station, Tallahassee, Florida, 1973.

Rudy Brats, A Taxonomy of Communication Media, Rand Corporation, Santa Monica, California, 1972.

Leslie J. Briggs, et.al., Instructional Media, American Institute for Research, 135 Worth Bellefield Avenue, Pittsburgh, Pa. 1967.

Abraham Kaplan, The Conduct of Inquiry, Chandler Publishing Co., San Francisco, Calif., 1964.

MEDIA SELECTION MODEL

	Representative Mode	Message Considerations		Learning Considerations	Optimum Media
CLEAR COGNITIVE MEANING	**Symbolic** This mode requires high order cognition and a correct knowledge of symbolized information. Through the medium of information processing, retrieving, inferring, and synthesizing learning can take place. Dispositions and values attached to the symbols shape perception. Learning is dependent on and a product of cognitive ability, cognitive motivation and selective perception.	Cognitive Motivation	Structured, Limited Information–Experience	Verbal Learning	Printed Materials Direct Oral Communication Oral Readings
↕	**Ikonic** This mode requires the ability to infer by association, the nature of some phenomena in terms of objects and realia. Through the medium of observation, categorization, association and extrapolation learning can take place. and values determine the level of interest or concern the learner may have. This level of interest, in turn, becomes a mediator of the impact of the media on the learner.	↕ Socio-Ego Motivation ↕	↕	Object–Vicarious Learning Social Learning Through Inference	Still Pictures Motion Pictures Observing Prepared VTR's Socio-Drama Psycho-Drama Structured Panel Discussions Use of Artifacts & Physical Models Exhibits
UNCLEAR COGNITIVE MEANING	**Enactive** This mode requires inquiry behavior that, through a positive reward system, can lead to habitual behavior. Through the medium of actual, at times physical, manipulation of information sources the senses are employed to learn in a heuristic manner. Repetitive experience will strengthen interest and a propensity to inquire.	Visceral Motivation	Unstructured, Rich Information–Experience	Direct Social Stimuli	Personal Participation in Argumentation Recording Self on Audio Tape Recording Self on Video Tape Contrived Experience Direct Personal Experience

1. Do you want clear cognitive meaning to result from the simulated experience?
2. Choose a representative mode that is most appropriate.
3. Consider motivational, experiential and learning attributes of the activity to be simulated.
4. Choose the optimum medium for the teaching-learning function.
5. If you can't choose from several equally acceptable media, which incurs the least cost to you?

'WHERE ALL ELSE FAILS' - an approach to defining the possible uses of Gaming-simulation in the decision-making process.

R. H. R. ARMSTRONG and MARGARET HOBSON, Inst. University of Michigan, Ann Arbor, Michigan 48104

Introduction

Gaming-simulation is concerned with decision-making. Whatever the subject matter a gaming-simulation exercise provides an environment within which aspects of the decision-making process can be simulated. The environment provided is made up of a number of components which combined provide points of reference for the participants in an exercise; these components[1] are:

(a) Role definitions - statements describing the specific situations within which the various decision-making bodies/groups/individuals are placed at the start of an exercise, together with some account of the type of activities they may or may not undertake.

(b) Scenario - a description of the general situation with which all the roles are confronted.

(c) An accounting system - some means of recording decisions and their consequences in such a way that both the scenario and the specific situations of the various roles can be amended. The accounting system covers both the 'model' and the means (e.g. a computer) used to process the decisions.

(d) Roles and procedures - a structure for the exercise providing a framework for the activities of the participants.

Gaming-simulation exercises are distinguishable from other forms of participative exercise by the fact that all four of these components are present. The emphasis placed upon any one of the components and the manner in which they are defined or presented may vary, as may the way in which they are combined, to suit the objectives being pursued in a particular exercise. Ignoring for the moment the variations that can be produced by differing emphases placed on particular components, the manner in which anyone or all of the components are defined and presented can vary from the precise detailed definition to the 'open ended' presentation. The more precise the definition of any component the less freedom there is for participants to experiment[2] in that area. Such precise definition implies one of two approaches to the use of an exercise, either:

(a) it is being used as a teaching mechanism and the lessons to be learnt are 'contained' in the definition;[3] or

(b) the definition is regarded as a 'first approximation' to be tested during the running of the exercise.

Given the short history of gaming-simulation to date (other than by the military) part of the lack of acceptance of the approach by those engaged in the practical business of decision-making has been due to a 'distrust' of the precise definitions built into gaming-simulation exercises by the academic practitioners of the art. There has been an implicit assumption made by the academic practitioner to the effect that what is appropriate for the 'traditional' undergraduate or graduate student is also appropriate for those engaged in the process of decision-making.

By contrast the use of more 'open-ended', less precise definitions provides an opportunity for the participants in an exercise to develop and 'fill-in' the original definitions by revealing their own perceptions of what is important. This can also be achieved when precise definitions are used if those definitions are regarded as a 'yardstick' and an opportunity is afforded the participants for their amendment.

The argument is that gaming-simulation can be of greatest assistance in the decision-making process if it is viewed as a means of enabling those involved in that process to make their perceptions of a situation explicit. This argument is based upon the assumption that what is important in the decision-making situation is not the nature of 'reality' but rather the decision-maker's perception of 'reality'. If this is accepted then gaming-simulation exercises used in the decision-making process become one means of eliciting, and exploring the implications of the decision-maker's perceptions.

Such an approach does not imply that the decision-maker's perceptions are, or should be accepted as 'correct', but rather that until they are made explicit they cannot be subjected to challenge, neither are they so amenable to change. Further, until the decision-maker's perceptions are made explicit the possibilities for communication with others involved in or affected by the decision-making process are less than they otherwise would be.[4]

Making explicit the perceptions of those engaged in the decision-making process can be described in more detail by reference to a number of processes, namely:

(a) Developing an appreciation of the nature of the 'system' with which they are involved in terms of:

- the elements that comprise the system and their possible interrelationships

- the role(s) of other decision-making groups or agencies

- the sensitivity of the 'system' to their own and others' decisions

- the nature of the problems with which they are confronted

(b) Identifying possible alternative decisions/courses of action open to them.

(c) Identifying possible consequences attaching to alternative decisions/lines of action.

(d) Establishing the relevance of data/information to the making of choices between the available decisions/courses of action.

(e) Developing an understanding of the nature and sources of uncertainty affecting the decision-making process.

(f) Establishing the extent to which there is a consensus (or lack of it) amongst those engaged in the decision-making process on points (a) to (e) above.

In what follows three approaches to using the components of gaming-simulation to facilitate these processes will be described briefly. All of them are frameworks each capable of adaptation to specific situations, they are:

- ALEA
- NEXUS
- SIMULATION CONFERENCE

ALEA[5]

ALEA is a format that has served as the basis for the construction of a number of gaming-simulation exercises directly relevant to practical situations.[6] The main objective of the exercises has been to investigate the relationships that do, or might exist between the various decision-making agencies involved in a situation. An additional objective has been to identify the information needs of the decision-making agencies. The general approach has been one of defining all the components in minimal terms so as to allow for development and change, not only from one exercise to the next, but also during the course of any given exercise.

Initially this approach was developed in response to the type of participant in the exercises being run, all of whom were senior officials in local government with an average of 15 + years experience. Given this situation it was felt to be inappropriate to construct a gaming-simulation exercise which required the participants to 'abandon' their knowledge and experience in order for them to participate. Rather it was decided to construct an exercise based upon the provision of 'points of reference' which would serve as the basis for the participants to use their knowledge and experience to develop the content in detail.

Role definitions are specified in terms of the activities the agency represented is undertaking at the start of the exercise. This is supplemented by information concerning the current (start of play) position of the agency. Objectives and attitudes of the agency are not specified except insofar as they are relevant to the past history of the role and therefore necessary to the description of how the current position developed. In this way it is made possible for the role to determine its own objectives, and to change them during the course of the exercise. Pursuit of such objectives being by means of manipulating the balance as well as expanding or contracting the range of activities undertaken. Within this context restraints on the activities of roles are provided by the extent to which any activity is acceptable to or negotiable with other roles represented in the exercise.

The scenario presented normally consists of three elements:

(a) A written description

(b) Statistical material

(c) A schematic map.

All of this material is designed to do no more than provide a set of indicators which will enable the participants to gain an appreciation of the type of situation with which they are confronted. While it is not presented directly to the players the information contained in the scenario is supplemented by having available more detailed reports, statistical sources and maps relating to the situation.

The accounting system used consists of two parts: First, a NEXUS[7] 'model' which records consequences of decisions in both quantitative and qualitative terms; and second, a general base map on which decisions having spatial consequences can be recorded.[8] Both these elements of the accounting system provide flexible frameworks for handling changing situations during the course of an exercise.

The rules and procedures used are designed to provide a minimal organizational framework for the conduct of the exercise, as well as to ensure that minimum records are kept to enable a post-exercise analysis to be conducted. The organizational framework is concerned with defining the timing and sequence of activities in the exercise. Any round of play is divided into three or four periods as follows:

I Three Phase

(a) Assessment - roles evaluate their current position.
(b) Information collection - roles request additional information considered relevant to their situation.
(c) Decision period - roles contact each other where felt necessary to exchange information or negotiate on various matters, and make their decisions for the round.

II Four Phase

Where there are four phases this is occasioned by the fact that that NEXUS 'models' are not programmed to provide team accounts for the roles, and thus the fourth phase is an accounting period in which the roles summarize, from their own point of view, the consequences of the round. Such team accounting is confined to financial matters.

The record keeping during an exercise is undertaken by use of four forms:

(a) Decision Form - decisions are recorded together with any resource implications for the role taking the decision.
(b) Request for Information Form - requests for information additional to that contained in the initial scenario are made to the central team and the answers given recorded on the form.
(c) Contact Record Form - all contacts made with other roles are recorded together with brief details of information exchanged and the outcome of any negotiations that took place.
(d) Team Account Form - all transactions and events affecting resources available to the role are summarized by the participants.

In addition to the information recorded by the participants on the four forms there is a completed NEXUS card detailing the consequences of every decision taken and each event introduced into the exercise.[9]

Using the information contained in the forms and on the NEXUS cards it is possible to 'map' the progress of an exercise in a number of ways, each of which is capable of revealing some aspect of the participants' perceptions of the situation. In the simplest terms it is possible to plot the frequencies of such things as contacts, requests for information and decisions, either in total or round by round, thus providing some indication of the level of activity during an exercise.

More elaborate analyses can be undertaken involving:

(a) matching requests for information to

- decisions taken
- consequences of those decisions
- contacts between the roles
- accounts of the roles

(b) construction of sociograms or matrices indicating

- the pattern of contacts between roles
- the flows of information between roles
- the relationships between decisions taken by different roles

(c) matching any of the analyses from (a) and (b) above to the 'total' outcome of an exercise.

All of these forms of analysis can be undertaken for individual rounds of an exercise, for a complete exercise or for individual roles.

Whatever form of analysis is used its importance lies more in the fact that it can be fed back to the participants than as a straight forward historical record of what happened. By feeding back the analyses the participants can begin to question their own perceptions as revealed by the analyses. In the first place such questioning can be in terms of whether the analyses are an accurate record of what happened. If it is accepted as a accurate record the questioning can be concerned with the extent to which it is congruent with the experience of the participants. In this way 'first approximation' models can be used as 'yardsticks' against which to match the perceptions of those engaged in the decision-making process. The information gained can be used also as a means of amending the models used, thus increasing their relevance for the decision-making process.

NEXUS[10]

NEXUS was originally used solely as the accounting system in the ALEA series of games. It was then realized that given that it could be used in the context of a complex game there was no reason why it shouldn't be used in equally or more complex practical situations. The first example of its use in this way was in the City of Liverpool[11] for the purpose of examining some of the implications for management of the adoption of a P.P.B.S. approach within the authority. A second adaptation was to the problems of planning and resource allocation within the Fire Brigade of West Sussex County Council.[12] A number of other practical use developments have been undertaken in the past two years (1971-73).[13]

In all the practical applications known to the authors NEXUS has been used for one, or both, of two purposes:

(a) the evaluation of alternative courses of action
(b) creation of alternative scenarios of future situations.

Its use for these purposes has often indicated areas requiring further research and investigation, thus serving as a complimentary approach to problem appreciation.

Essentially NEXUS serves as a basis for making explicit perceptions of a situation by requiring that discussion follows a set agenda. The agenda is as follows:

(a) Definition of the 'System' under consideration - this stage requires users of the approach to list the elements/factors/variables considered to be relevant to the 'system' (situation) with which they are concerned. The elements/factors/variables listed can be of many types, ranging from the easily quantifiable to the completely (?) qualitative. This list provides the basis for the construction of the centre card of the NEXUS display layout.

(b) Identification of decisions and events affecting the 'system' defined - in this stage the main objective is to list those alternative decisions and (random?) events which may affect the 'system' defined in (a) above.

(c) Evaluating/indicating the consequences of decisions/events affecting the system - four sub-stages are involved in the use of the approach at this stage:

(i) identifying which of the elements/factors/ variables defining the system are affected by the decision/event under consideration
(ii) determining the unit of measurement to be used (if any) in calibrating the effects identified, (i) above
(iii) determining the direction of the effects identified in terms of the units of measurement determined, (ii) above. It should be noted that direction of effect is interpreted only in quantitative terms and does not carry with it any connotations of 'better' or 'worse'
(iv) deciding the magnitude of the effects in quantitative terms.

It will not be possible to complete all of these sub-stages in relation to every element/factor/variable included in the original description of the 'system'. In respect of the 'qualitative' elements it may only be possible to proceed as far as (i) above i.e. to count the number of times they are affected. The object at this stage is to proceed as far as is possible with the evaluation of effects. If the process has to stop short in respect of any particular element/factor/ variable this will almost certainly be an indication of the need for further research/investigation.

In the process of using the agenda provided by NEXUS those engaged in the decision-making process reveal their perceptions of the situation with which they are confronted. Insofar as such perceptions are 'programmed' onto NEXUS centre cards they provide the raw material from which gaming-simulation exercises can be constructed - representing not what the 'real' world is actually like but how those engaged in administering it perceive it. While it is of value in their own right as aids to decision-making such perceptions can serve as invaluable training tools for those about to assume positions of responsibility in the decision-making process, insofar as they reflect the attitudes and values of those who presently carry the responsibility for (advising on) decision-making.

Simulation Conference

The development of the Simulation Conference approach arose primarily as a consequence of the inability, in many instances, to apply quantitative measures to the effects of decisions/events upon the elements/factors/variables used to describe the system under consideration. In the absence of 'hard' numbers various rating scales can be applied, but all of these suffer from the defect that they implicitly assume on 'equality' amongst the decisions/events being evaluated. The Simulation Conference methodology[14] overcomes this problem by providing a means of developing an 'Impact-Score' for each decision/event, which while it is an arbitrary number does reflect a given group's perception of the relative importance of a specific decision/event.

The 'Impact-Score' is developed through the use of a DELPHI[15] approach supplemented by the use of CROSS-IMPACT ANALYSIS.[16] In the DELPHI stages of the exercise participants are asked (given a specific future date) to:

(a) Give their estimate of the probability of implementation/occurrence of each decision-event by awarding a score out of 100

(b) Rate[17] the desirability, from their own personal viewpoint, of the implementation/occurrence of each decision/event

(c) Rate the significance for the system under consideration of the implementation/occurrence of each decision/event

(d) Rate their own expertise in relation to each decision/event.

The responses are fed back to the participants in the form of histograms together with associated statistical measures e.g. mean, mode, median and interquartile ranges (where appropriate). This process of feeding back the complete analysis of responses is important because the 'Impact Score' is calculated using selected measures.[18] To feed back all the results enables participants to judge the appropriatenes of the particular measures used.

Between the first and second rounds of DELPHI participants are asked to undertake a CROSS-IMPACT ANALYSIS. Only after the Cross-Impact Analysis is the second round of DELPHI conducted.[19] The 'Impact Scores' derived from the second round of DELPHI are then used as the basis for assessing the 'impact' of the decision/event upon the 'system' under consideration.

The 'system' is defined in terms of the elements/factors/variables displayed around the perimeter of a NEXUS card. (Participants are provided with a 'check-list' defining the elements/factors/variables together with the unit of measurement, if any, to be used with each). Participants are asked to proceed as follows:

(a) Indicate those elements/factors/variables affected by the decision/event being considered.
(b) Indicate the direction of the effect.
(c) Distribute the 'Impact Score' amongst the elements/factors/variables shown as affected. The 'Impact Score' to be distributed under the following conditions:

    (i) Not all of the 'Impact Score' need be distributed.
    (ii) No more than the total score can be distributed - ignoring signs indicating the direction of the effect when totalling.

Individually the completed NEXUS cards provide an explicit statement of perceptions concerning the relative 'impact' of a decision/event upon the 'system'. Taken collectively, or in various combinations, they enable the 'total' perceived 'impact' of a series or selection of events to be made explicit. By manipulation of the set of completed NEXUS cards it becomes possible to generate alternative scenarios of the future.

The final stage of evaluation by the participants consists of them writing, in prose form, a scenario based upon the results of all stages of the Simulation Conference. Equally, the completed NEXUS cards can serve as the basis for the construction of a game, and the game process used as the means of generating alternative scenarios.

To date the Simulation Conference has been used to generate scenarios relevant to issues concerned with manpower planning in local government. It is being developed, and adapted, to provide one means whereby computer simulations can be built (or amended) to explore the implications of the perceptions of different groups of planners and decision-makers. There is also a growing demand for its use as an 'educational' device in that it provides a disciplined framework within which those engaged in the decision-making process can review their own attitudes to changing situations.

CONCLUSION

In all three of the examples described gaming-simulation techniques provide a framework for the investigation of practical problems. ALEA emphasizes the relationships between decision-making agencies - the roles involved - while NEXUS is concerned primarily with the use and manipulation of an accounting system for evaluation of alternative courses of action. The Simulation Conference provides a means of generating scenarios. What they all have in common is that they depend upon inputs from the participants. None of them are designed to 'teach' a particular lesson. All three approaches have as a common aim the creation of an environment in which those engaged in the decision-making process may become more self-aware.

The development of self-awareness is not the whole of the decision-making process. Any contribution that gaming-simulation techniques can make in this area will serve only to compliment other approaches. One lesson gaming-simulation teaches all its practitioners it that there are no such things as final solutions to problems. The danger practitioners of gaming-simulation must learn to avoid is that of thinking (pretending?) that what they have to offer will solve the problem of decision-making.

NOTES

1. A fuller description of these components is contained in R.H.R. Armstrong and Margaret Hobson "Introduction to Gaming-Simulation Techniques' in ALEA LOCAL GOVERNMENT GAMING SIMULATION EXERCISE (T241 LG). The Open University 1973.

2. While this is true in general terms experienced game operators are well aware that participants can 'revolt' and change aspects of an exercise to suit their own purposes.

3. 'Contained' in the exercise in the sense that the lessons will be made explicit by use of the definition during the course of an exercise.

4. It is accepted that gaming-simulation can serve as a communications 'channel' and that this can proceed along-side the process described in this paper. However, this particular aspect will not be dealt with, except in passing, as it is felt to involve specialist topics which would be inappropriate to the main theme.

5. ALEA is a generic Latin term covering games of chance, especially those played with dice. Our choice of ALEA as the title for a series of gaming-simulation exercises we developed in the Institute of Local Government Studies (University of Birmingham, England) was influenced by the fact that on crossing the Rubicon Caesar reportedly said, "i am ALEA iacta est" ('now is the die cast'). We felt that if gaming-simulation was to have relevance to the decision-making process a title emphasizing the association with the 'Rubicons' encountered in decision-making would be appropriate.

6. The range of subjects covered in the ALEA series is as follows:

   - New town development
   - Impact of a new town development upon an older town undertaking a programme of urban renewal
   - Local government reorganization
   - Conservation of historic city centres

7. A description of the basic mechanics of NEXUS is contained in R.H.R. Armstrong and Margaret Hobson, "The Use of Gaming-Simulation Techniques in the Decision-Making Process', paper presented to the United Nations Inter-regional Seminar on the Use of Modern Management Techniques in the Public Administration of Developing Countries, Washington, D.C., October 1970.

8. The general base map is generally of the type used in C.L.U.G. and WALRUS (Allen Feldt, University of Michigan, Ann Arbor) on which land uses and other spatial characteristics can be indicated by the use of symbolic models.

9. There are a number of ways in which the NEXUS cards setting out the consequences of decisions/events can be 'programmed' for use in an exercise. Three main alternatives are available; the cards may be 'programmed' by:

    (a) the control team either prior to or during the exercise
    (b) a team of 'umpires' during the exercise
    (c) the participants themselves

    It is also possible to use various combinations of these three alternatives.

10. NEXUS is a Latin word meaning the point at which things come together. The display format used in NEXUS was developed from the game FUTURES devised by Olaf Helmer for the Kaiser Aluminum Foundation. Development of the NEXUS approach has been based on elaborating a methodology for use and adaptation of the display mechanism.

11. R.H.R. Armstrong and Margaret Hobson, 'Program Planning Simulation - City of Liverpool', Institute of Local Government Studies, University of Birmingham (England) July 1970.

12. R. B. Blackburn, 'Interaction Evaluation by Simulation', FIRE MAGAZINE, 1971.

13. Amongst examples of the use of NEXUS are the following:

    - Social Services (long-range planning)
    - Management Services (productivity bargaining)
    - Transportation (road network planning)
    - Structure Plan Evaluation
    - Crisis Management

14. R. H. R. Armstrong and Margaret Hobson, 'Simulation Conference - notes on procedures and methodology', Institute of Local Government Studies, University of Birmingham (England) 1973.

15. Olaf Helmer, 'Social Technology', Basic Books, New York, 1965.

16. S. Enzer, 'Delphi and Cross-Impact Techniques - an effective combination for systematic futures analysis', Institute for the Future, Middletown, Connecticut, 1970.

17. The rating scale used in relation to desirability, significance and expertise is graded 1, 2, 4, 8 (supplemented in the case of desirability by + or - to indicate approval/disapproval) as it has been suggested that people find it easier to distinguish gradations when a ratio scale is used.

18. The 'Impact Score' is calculated using the mean of the probability distribution and the modes of the significance and expertise distributions. The formula used is:

$$I = \bar{P} \times S_m \times \frac{E_m}{8}$$

Expertise ratings are 'discounted' by the division by the highest possible rating and thus the 'Impact Score' reflects the group's perceived importance of the decision/event taking into account its acknowledged level of expertise. The process of division is not strictly necessary but it reduces the 'Impact Score' to a number of more manageable proportions. Given this 'discounting' it is felt that use of the mean of the probability distribution, rather than the median is justifiable, though where there is doubt concerning its 'validity' either the median or mode can be substituted in the formula.

19. The CROSS-IMPACT ANALYSIS stage is introduced to provide a focus for reconsideration of the decisions/events included in DELPHI. Results from the CROSS-IMPACT ANALYSIS are not used for any specific purpose in later stages of the exercise.

SIMULATED UNIVERSITIES*

H.A. Becker
Department of Sociology
University of Utrecht
2 Heidelberglaan, Utrecht,
The Netherlands

1.0 INTRODUCTION

1.1 The Academic Revolution

By now the members of the academic community and the public in general are willing to recognize the fact, that the university system is experiencing a revolution. This process started with a period of dignified and almost dull structural change, lasting from about 1950 until 1968. The number of students grew rapidly almost in every country. This growth, plus a change of the contents of science and educational technology, forced the system to reorganize itself. From 1968 until about 1971 the scene changed dramatically. The students revolts brought the discontent, difficulties and resistances to the attention of politicians and the general public. Since 1971 the revolution has entered a period of less tumultuous but still fundamental and rapid change. (1)

This revolution in the house of science has induced quite a number of research institutes and individual scientists to apply the instruments of science to the reconstruction of their own house. For instance in sociology we see quite a boom in the sociology of education, the sociology of science and the study of the management of science and of higher education. In the course of this development attention has been given to the application of simulation techniques. Especially the field of economics has contributed a number of valuable simulation models of university systems.

The application of simulation techniques to the field of university systems is not without problems. Are these models adequate models? Could we get rid of their deficiencies? What strategy could help us to get better models and a better application of these models in policy making etc.?

---

* The author is engaged in a research project, in which a number of simulation models of university systems are developed. The project is financially supported by the Netherlands Foundation for Educational Research. It is carried out at the Department of Sociology, University of Utrecht, 2 Heidelberglaan, Utrecht, The Netherlands.

1.2 Background of this Chapter

This chapter is based on a pilot study of the models of university systems now available. In this project we conducted a survey of the literature on university simulation, and we visited a number of specialized research institutes in the United States, England, France and Germany. The project started in 1971, and in 1973 a report on the findings was published (2).

In the meantime based on the results of this pilot study three research-projects have been started. The first one is directed at the development and implementation of a number of simulation models, that take teaching, research and external services into account. The second project tries to elaborate on the system of research activities in the social sciences. The third project is going to build a faculty flow model. The three projects are restricted to the situation in the Netherlands.

This chapter gives an inventory of the types of university simulation models, and gives some examples in each category (paragraph 2). It continues with an analysis of a number of problematic aspects in these simulation models (paragraph 3). It concludes with some remarks on the strategy of developing this field (paragraph 4).

We will not elaborate on the concept of simulation used in this F chapter, because this subject is dealth with in the chapter on "the data behind simulation models."

2.0 UNIVERSITY SIMULATION: MODELS

2.1 Introduction

Numbers mean little, but as an illustration we should have liked to be able to mention the number of models of university systems now in use. Especially because of the sharp growth of the number of models in recent years such a survey cannot be given.

The agency which has documented these developments best, is OECD in Paris. This organization has undertaken an inquiry in its member-states in 1969 (1). This inquiry had a bearing on models of educational systems, so not only simulations are involved. We have the impression that about 2/3 of the number of inventorized models comes within the definition of simulation. This inquiry was not restricted to university systems. However, a rough separation can be made between models which wholly or partly have a bearing on systems of "higher education", and models of other educational systems. In diagram 1, we have given a survey of the models. To what extent has this picture become obsolete? We are under the impression that - the number of models at least - has been doubled in the years since 1969. Since 1969 the OECD documents the new models which come to their knowledge. However, this organization no longer pretends to be able to give a somewhat complete picture.

The only comparable study of a great number of models is by Weathersby and Weinstein, and dates from 1970 (2). This study gives a structural comparison of analytical models for university planning. Thirty models are compared, of which 12 are regarded by the authors of the study as simulation models. Of these 12 models only one to a certain extent can be used in the field of training, change agency, etc. In the next paragraph reference will be made to the findings of Weathersby and Weinstein.

Per category we shall give some examples of models. The examples claim to be able to be typical of the category and to be able to illustrate the category. They make no pretence to give a representative picture of the category, quantitatively speaking.

2.2 Allocation Models

In a Norwegian study of 1969 (3) an estimate is made for nine university departments of the numbers of freshmen, the number of those graduating, etc. On a number of alternative conditions the researchers arrive at estimates for 1975. They have the impression, that the results of their calculations have somewhat more influence on policy making than calculations on the basis of trend-extrapolations and the like. The OECD-paper, which gives a description of the model, contains also an evaluation by the researcher themselves.

"The experience gained by constructing and solving the model, as well as the awareness of the model-builders of almost all the weaknesses of the model, is very encouraging for the necessary future improvements of the model. We would like, however, to conclude our report with the following general remarks which may prove helpful to the model-builders in any future work on the post-mortem.

a. The lack of a workable theory of how the educational system operates and of study patterns have forced the model-builders to make unrealistic assumptions.

b. Behavioral elements should be introduced into the model either directly, through behavioral equations, or indirectly by exogenous estimatio of the various coefficients based on behavioral factors.

c. There is lack of simultaneity in the system of equations. This means that there is no feedback mechanism in the model. That is, each step is determined by the previous, which in turn determines the next step. This, again, is an over-simplification of relationships.

d. There is no consideration of the size of the model and there is no justification for the choice of the level of aggregation. We know, however, that the larger the size of the model, the larger is the error resulting from "noise" generated by solving the system of equations. It would be desirable, therefore, to check errors involved in disaggregating the system into such great details.

Diagram 1. Models of Educational Systems; OECD Survey 1969*

Country	Number of Models	(Related to Higher Educ.)	Member Country	Number of Models	(Related to Higher Educ.)
1. Austria	2	(2)	11. Norway	11	(8)
2. Belgium	7	(6)	12. Portugal	1	(1)
3. Canada	14	(10)	13. Sweden	1	(1)
4. France	8	(7)	14. Turkey	2	(2)
5. Germany	14	(9)	15. Switzerland	2	(0)
6. Iceland	1	(0)	16. United Kingdom	15	(8)
7. Ireland	6	(1)	17. United States	14	(11)
8. Italy	3	(1)	18. Yugoslavia	2	(1)
9. Japan	8	(1)	19. International organizations	3	(2)
10. The Netherlands	6	(6)			

*O.E.C.D., Directory of Current Educational Models in OECD Member Countries, Paris 1969

e. The results produced by the model should be compared with results produced by other more aggregated and/or naive models. It had often been the case that more aggregate models have produced more acceptable results."

This minute example of self-criticism does not need to be supplemented. But he fact does need to be stressed that these model-builders themselves also provide us with possibilities which may lead to an improvement of their model.

Our next example is a product of the Netherlands. By a working group under the chairmanship of Prof. Dr. D.A. De Vries, a report was published on "numerical consequences of the envisaged structural change in university education".(4)

This simulation, published in 1971, scans some consequences of the bringing into effect of the proposals by Posthumus on the reduction of the duration of the study course and of the enrollment at Dutch universities and university colleges.

The working group De Vries also mentions the consequences regarding the number of personnel, accommodation etc... These consequences, however, are not intensively involved in the simulation model. That is why we count this model among the allocation models and not among the production models.

In this simulation, each time the passing through the educational system of 100 freshmen is examined before the structural change - and of 100 freshmen after the structural change. In the memorandum the reservation subject to which the estimations are given is fully considered. Roughly calculated the estimation boils down to a decrease of the number of enrolled students by 30% and of the number of students passing through the university by 20%.

Thirdly a simulation by Albinsky, Geurts and Schute, who examine the consequences of a numerous fixus for a great number of faculties (5). This simulation, dating from 1972, proceeds on the expected inflow of students according to the data of the National Planning Agency (central Plan Bureau in the Netherlands) and on the patterns known from inquiries of first and second choices with regard to faculties. The assumptions of the researchers were:

a. because the choices show that entering a university as such, and certainly also studying at a university, are rather taken for granted, freshmen who cannot pursue their first choice, will choose a university-study which come closest to the indices of their preference.

b. this has the result that a numerous fixus in a certain faculty causes an overflow into the most closely related faculties. If that happens to a large extend, the introduction of a numerous fixus in several faculties might result in the fact, that other faculties, in their turn, get capacity problems, which they have to get rid of. If for that problem the solution of a numerous fixus is chosen too, this, in its turn, can bring still other faculties into trouble.

c. if we want to examine whether something of the kind is within the range of possibilities, we shall have to have insight into the way in which the students will divide if they cannot follow their first choice due to a numerous fixus. In this project we have taken it for granted that this happens according to the percentages of preference for alternative studies...."

As a result of their calculations, the researchers assume that a numerous fixus, introduced in 1972, will not produce a great effect until 1976. They assume, too, (as was already hypothesized theoretically), that the satisfactory effect for some faculties often goes together with a dissatisfactory effect for other faculties. This report, too, develops the analysis and the deductions with a gradation of reservations.

Remains to be recalled that the National Center for Higher Education Management Systems (NCHEMS) in Boulder, Colorado, is developing a student flow model, which permits a rather detailed "monitoring" of the study course per student and per category of students. Of this model, so far, only a preliminary description is available (6). It may be clear that such a model can only be used to good purposes, if the student administration is reliable, detailed and up to date.

2.3 Production Models

We are now entering a domain which accommodates many dozens of well-known models. The show-model is the one developed by the Systems Research Group in Toronto (7). The first variant dates from 1965. At present the eighth improved model is in use. CAMPUS, in full: "Comprehensive Analytical Methods for Planning in Universities College Systems", is attuned especially to "resources planning". The model draws into consideration: flows of students, systems of teachers, need of other personnel, consequences with regard to space and cost of student provisions. It can be supplemented by a model for building activities, in which also allowances have been made for the developments of the capital market, inflation and the like.

The model can be supplied with a sub-model for the planning of a medical faculty including clinical activities. It is now being applied not only in the university sphere, but, (with adaptations), also for higher vocational education and secondary education. Expansion to primary education is in course of preparation. Per user can be determined which degree of details works best. The user can change components of the model by hand, owing to which it can also be used as an instrument for training and as a planning tool.

A comparable design has the RRPM (Resource Requirements Prediction Model) NCHEMS at WICHE, Boulder, Colorado (8). This simulation, too, is tuned to determining long-term and medium term policy. It can especially be used to calculate the consequences of decisions, which will have an effect over several years. On a limited scale the user can experiment with this model, too, with variations on the master model.

Our next example is a German model. The Hochschul-Informations-System in Hannover has, for the faculty of English philosophy and literature, conducted a research into the question, how many students the university can admit. Some years ago this faculty abolished a numerous fixus. That is why an exact estimation of the number of students that could be admitted did not apply. It was especially a question of developing an instrument for short- and medium-term planning. The result is a calculation model on the level of a department or faculty, which enables, o.a. analyses to be made of bottle necks in the allocation of teachers, and which shows the optimal use of rooms for lectures and working groups. The data-basis, required for these models, can be realized without too great an investment of man-power (9).

From HIS we also derive our next example. A. Hage c.s. have developed a model for the faculty of geology at the university of Freiburg. They began with an inventory and analysis of the state of affairs, partly on the basis of existing administrative data, partly on the basis of inquiries. Based on these, a calculation of needs for the coming period was made. Thirdly, an optimal "re-allotment" of the available supply of space was brought about, in preparation of an internal removal. Involved were seven institutes and a secretariat of the dean. Besides educational facilities, the model also goes into the pursuit of science and professional perspectives for graduates.

Because of the latter components this model is an asset (10).

In the Netherlands, too, production models for parts of the university system have been developed. Within the framework of a project of international co-operation under the auspices of CERI/OECD a calculation model has been designed and tried out by a team of the University of Nijmegen (leader of the project: J.L.M. Goossens), which is based mainly on the standards of the Overbeek Committee. The model has for instance been applied to the sub-faculty of psychology in Nijmegen. In view of the design of the Overbeek method, not only education, but also for instance te pursuit of science could be brought into the scope of the model. The report by Goossens c.s. arrives at an extensive survey of the factors which have been taken into account when applying a differentiated version of the Overbeek method. In this report the reservations under which the findings must be used, have been worked out with great care (11).

In this series of examples of production models we finally mention the Total University Simulation System (TUSS), which has been developed by De Nie at Utrecht University. The model can draw students, scientific staff, administrative staff, supply of space and financial data into the analysis. The model is being prepared for a number of uses in several rounds.(12)

2.4 Interaction Models

There are many rather simple simulations of university systems which enable a faculty etc. to be simulated with a limited number of rules and a limited quantity of game-material, and which are suited for purposes of instruction. This category includes the "madingly Game", written in 1969 by D.J. Warren Piper and J. Race in Cambridge. The nature of this game can be summed up best by mentioning the parts which have to be fulfilled:

a. principal of college
b. administration of college
c. academic staff
d. students
e. National Union of Students
f. Local Educational Authority
g. Summerson Council (which grants scholarships)
h. the press
i. the public

Participants have to arrive at a College policy, including such matters as drafting an educational program, appointing scientific staff and admittance of students. After five years a deputation of Summerson Council judges the quality of the activities of the College (13).

EDPLAN of Clark Abt Ltd. at Cambridge, Massachusetts is in the field of the commercial games. This scenario relates to educational planning on the level of secondary education and "colleges", but is in closely enough related to university simulation to be of interest for the present inventory.

Persons interested can acquire a complete set of game-material, with which from 27 to 38 players can simulate a process of educational policy. A team of participants has to prepare and submit a budget for a number of schools, and another team must judge the budget. The designers of the budget are from the category of head masters and school boards; those who judge the budget belong to the category of town councillors. There are representatives of the professional organization of teachers, the student association, etc. Each participant finds in the rules of the game a description of the number of votes he may cast during the procedures of decision-making. The leader of the game does not need to have a special training in managing such games. It requires little imagination to conceive the working of such a simulation. This can, for instance be a very useful aid to train members of a schoolboard quickly and efficiently. The expert commercial approach guarantees that the scenario is tested sufficiently to make good what it promises (14).

By Abdul Khan and P. Levasseur of OECD, a simulation was introduced in 1969, which has as its object a complete educational system.

The GAME-model (Global Accounts for Manpower and Education) has three teams of participants; an "educational planning team", a "manpower planning team", and an "economic planning team". The purposes of the model are as follows:

a. the presentation of a computable model which could be used by educational and national planning authorities;

b. the exposition of certain basic concepts and quantitative techniques in educational-manpower plan formulation;

c. the simulation of the process of interaction which takes place explicitly or implicitly between different departments and functions of a national administration.

To give it a concrete form, data on the French educational system were introduced. The comment upon the practical application states o.a. the following:

'Designing a game forces one to take a systematic look at the entire socio-economic system of a given country involving collection, standardizatior and processing of information....It was during the operation phase that the major benefits of having invested time and effort in the construction of the game were realized. These benefits multiple each time the game is repeate for different players.....For real life decision-making these benefits of the use of a single simulated environment for planners from many different countries. It would be interesting to compare this experience with a game based entirely on one country and using planners of that country to play out their respective roles iwthin the simulated environment.'

This comment contains a good number of wise lessons for further model building. Reference will be made to this point in the next chapter.

In "Outlines and Development of Two Games on University Planning", a doctoral essay written at the State University of Michigan, Frank Zilm evolves two secnarios, which in the Netherlands would be characterized as "critical gaming". The "Comprehensive Higher Academic Operations Simulation (CHAOS) Game" addresses itself to those, who already know the (American) educational system rather well. It brings quantities, such as the relative status of the various faculties within the game. The "Vice Chairman" has four "votes" in the decision-making, the students altogether two "votes", so the scenario cannot be blamed for having a romantic prejudice. No more romantic is the following passage:

"ironically, amny important decisions pertaining to a higher educational system, are made by persons in positions where only a part of the overall operating situation is understandable".

The game-positions are:

a. policy-makers (president, vice-presidents)

b. deans of faculties

c. members of the scientific staff; and

d. students

The scenario offers a formula, in which the simulated needs of the university affect the policy capacity of the simulated university. This policy capacity becomes smaller, if little is done regarding that need of society. Furthermore, the accomplishments of the simulated university are being compared with data on another, comparable university.

The second game by Zilm is known as "The Dynamic Academic Resource Theory Simulation (DARTS) Game". It is meant to offer beginners in the field a possibility to work up to the subject. IT can be used as an introduction to CHAOS (15).

Finally we mention the Gaming Simulation of Tertiary Education, that has been developed by De Nie. This man-computer simulation has been successfully played by freshmen in 1972. At stake is the mapping out of a policy for three universities, which are associated with one another.

The model takes into consideration education and the pursuit of science. The quality-dimension is brought forward by passing a judgment, a.o. by awarding a "Prix d'excellence" to the best scientific publication in a given year. The background of the model is the enactment of the W.U.B. (Law on Reforming the University) and the structure of university planning. The development of this model is not yet finished (16).

2.5 Final Remarks

In this paragraph we wanted to typify the categories of simulations of the university system which are available at present. In the cases where the drafters of the models themselves went into the restrictions with regard to their pieces of work, we have made reference to this. In the next paragraph we shall go more fully into the aspects of the university simulation models, which on the one hand are the weak spots, but on the other hand are open to improvement, and which partly already are the object of attempts to improve them.

3.0 UNIVERSITY SIMULATION: ASPECTS

3.1 Introduction

In the previous paragraph we have taken a walk through a store with numerous models of university simulation. In this paragraph we shall examine "the" model of university simulation more closely, and in doing so, look for the aspects which, in the present connection, deserve special notice.

We can get hold of "the" model of university simulation most simply by looking at the stages which can be distinguished when constructing and using a model. Obviously university simulation models have the same aspects as simulation models in the social sciences in general.

The first group of actions needed to arrive at a simulation model consists of answering a number of question, i.e.:

(a) with which object do I have to deal exactly?
(b) what is the purpose of the construction of my model? Is it a case of theory-building research? Practical research? Instruction? etc.
(c) furthermore, in case of an analytical aim: What is the definition of my problem or complex of problems?
(d) can my object indeed be pursued best from a system-approach?
(e) can my object indeed be realized best by an approach with a dynamic model?

Next, the second group of actions. We must compose a list of components of our simulation model. Which quantities shall we take as constants, variables and parameters? Which variables are instrument-variables,which target-variables What is the scope of our system, and which variables are exogenous variables? If we want to look at the system for its optimum, we should also know, by which criteria this optimum (or sub-optimum) can be tested.

The third group of actions requires making explicit the parts of theory, social philosophy etc. which we shall employ in the construction and in the handling of our model. By theory we mean, very traditionally a body of propositions on social reality, whereby the propositions must have reached a high degree of abstraction and of verification. By social philosophy we mean a complex of opinions on the nature of society and on the characteristics of a good society.

With the fourth group we do not look up but down. Which empirical basis can we give our model? Are the available data sufficient? Do supplementary data need to be collected?

Among the fifth group of actions we reckon the actual designing, testing and putting into operation of the model. Think of the artistic inventiveness of designing an adequate, goal-wise complete, elegant and parsimonious model.

To this group of action also belongs the programming of the model for a computer, if necessary. Here, too, an artistic inventiveness is required besides a technical precision.

Finally the sixth group of actions. (This does not immediately follow the previous groups, time-wise. Generally speaking the groups of actions in question observe a more logical sequence than a sequence as to time). The activities to be dealt with finally, include looking at the validity of the model. This is true of both analytical and educational models, and the like. The essential question in this respect is: Is the "distortion" of reality in the model optimal? Validity and usefulness are interrelated: the use of the model determines the desirable degree of validity. In the concrete: Who keeps raising the validity, is finally left not with a very valid model of a university, but ends up with a real university in all its actual functioning.

We choose three aspects to be dealt with more closely: criteria (group 2), empirical basis (group 4) and the complex of validity and usefulness (group 6). Per aspect we shall consider what the present situation is like, and what will have to be improved in the years to come.

In doing so we have explicity chosen the three aspects, which, in our opinion, are the most problematical.

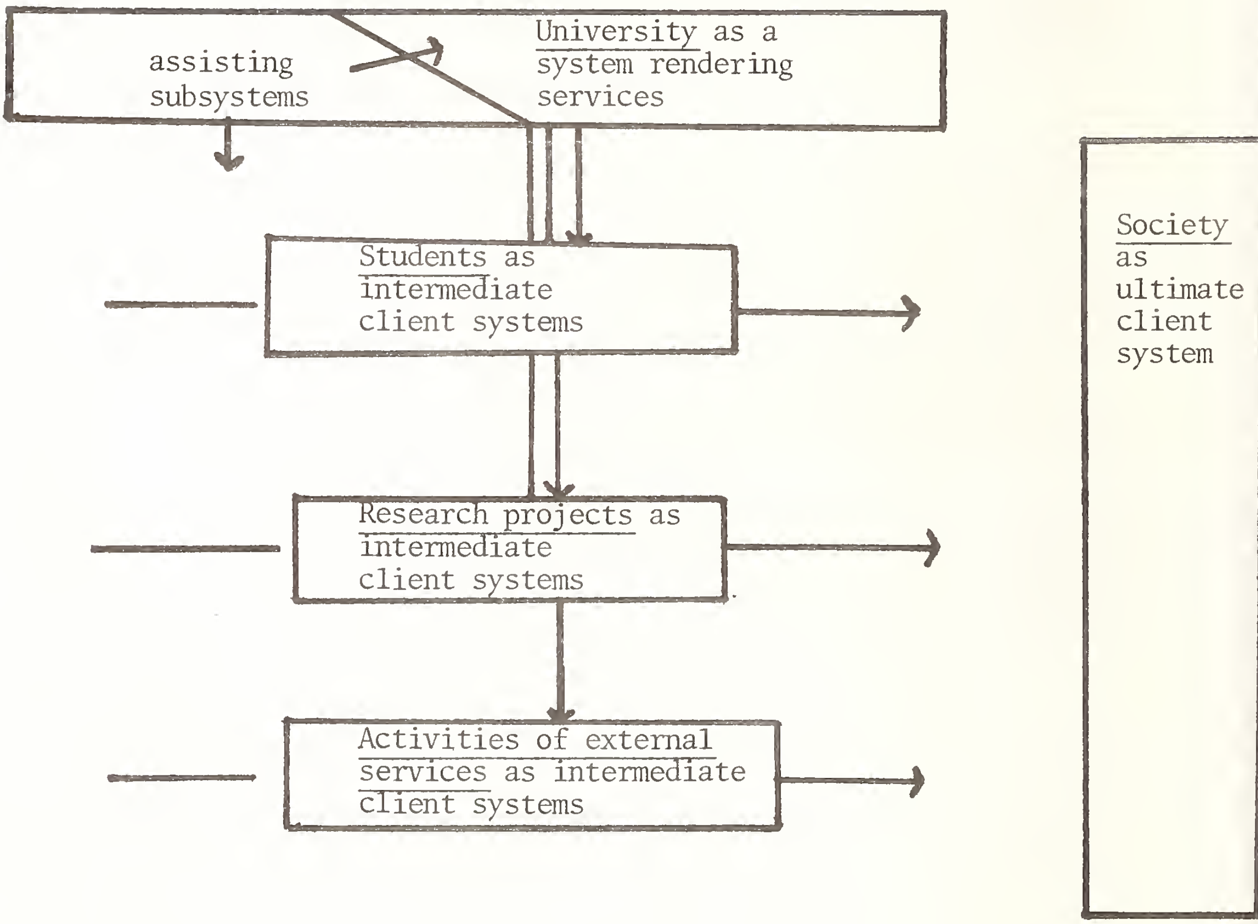
3.2 Criteria

Until recently, universities have been run on the basis of a number of traditions, stereotypes and rought-and-ready rules. That worked rather well, certainly as long as small, constant numbers of teachers students, scientific projects, patients and the like, were involved. Meanwhile, university education on a massive scale has become a fact, the pursuit of university science has become a part of "big science" gigantic university clinics will be mass-produced etc. From "management by tradition" to "management by objectives" is rather a transition. Radical students, economizing ministers, critical administrators have asked the centipede after its purpose and technique of walking. The first consequence is a continuous stumbling of our centipede. Let us hope that its walking in a few years' time will be smooth again, and moreover more efficient than at present.

We shall have to come to see the university and its faculties, subject group etc. as service systems. Services are given, and these services can be tested by criteria of effectiveness, justice etc. Three types of services are involved. In diagram 2, positions and processes have been amalgamated into a graphic scheme.

The first flow of services goes from the university as service system (especially scientific and administrative staff) to students, projects of research and other pursuits of science, and projects of external services. Students, research projects and external services are sometimes called the "target-system" of the university.

Diagram 2. The University and Its Client Systems



The second flow of services goes from students, research projects and external service to society. In this connection society is sometimes called the "beneficiary system", as the ultimate beneficiary.

The third flow of services supports the first stream, and, indirectly, also the second stream. Think of administrative activities, housing, student provisions etc. Think, also, of every systematic advancement of "motivation" of staff and students, although this stream in fact is still quite modest.

The three interdependent service systems need means in order to be able to function. System one and system three end in the second system, and this ends in society. In other words: We are concerned with an input, throughput and output of the total system and of each of the three sub-systems.

A scientific library can be an illuminating example in this connection, although this example is more complicated than one might think at the first glance.

Probably the input of means can be rather easily described and tested by criteria. New books and periodicals cost money, and free copies can be appreciated at their true value. The throughput includes the care of the library-personnel, the books, the housing, the presentation of the available books, to the visitors, to those who lend the books and bring them back. The output is the benefit which those who use the library derive from this service system. This can hardly be conceived in criteria. This profit, then, must influence the input and the throughput. The policy of buying has to support systematically the quality of the output.

Finding (a) categories for the description and (b) criteria of testing is now a field of scientific research and of scientific inventiveness which keeps many scientists and scientific institutions intensely busy, f.i. in the United States, England, France and Germany (1). Especially the University of California at Berkeley is working on a large scale at finding solutions, with financial aid of the Ford Foundation.

Speaking about this project in Berkeley, it is no coincidence that the same institution works with models of computer-simulation. The difficulties around the computer-simulation is one of the reasons why the criteria-project has been undertaken.

The survey-study by Weathersby and Weinstein dating from 1970 ends in the lamentation: "Up to the present, most models have tended to be simulations of educational systems, with outputs left dangling for haphazard evaluation at the end. A step in the right direction could be to run simulations but with some framework for evaluating the outputs" (2). Looking at the report on the conference on "outputs of Higher Education", also from 1970 (3), the picture is nearly equally gloomy. Also other studies on criteria for determining the results of the university system, f.i. by UNESCO (4), make clear, that we certainly cannot stop looking for hard criteria yet. Conclusion: Useful criteria are eagerly being looked for; the progress made is considerable and encouraging, especially in the U.S.A..

3.3 Empirical Basis

It requires a lot of time but is still rather easy to make a "theoretical" model of a faculty or a university. We do not mean to say that many really good "theoretical" models are available, but it is still possible to review the field, and this task can be accomplished successfully by one scientist within a few months.

Designing and realizing a model with an empirical basis is immensely more risky, lengthy, more expensive and more frustrating. At least if the model has to be attuned to important problems in that university system.

What about the empirical basis of simulations with regard to the university system and its components? This question can only be answered, if we differentiate the models - and, therefore, also their empirical basis, according to a number of levels.

The first level includes describing the situation and development of the university system by means of, comparatively speaking, rough quantitative indicators. This process of describing such dynamic systems is called monitoring. With regard to flows of students, the annual educational matrix of the Central Bureau of Statistics in the Netherlands may be regarded as a deserving commencement of monitoring. But, due to technical factors, the description is not available quickly enough, to follow the system in its development, concurrently with the actual events. In the United States a system has been developed for this purpose: at random a great many points of information in the scientific system have been chosen. By telephone the informants concerned are asked for a number of data at regular intervals. According to the "refreshing procedure" in a panel survey, the informants are replaced by others at regular intervals.

Especially in Canada the United States and Western Germany, the making available of a system of continuous information on processes in faculties, universities etc., is already being vigorously and successfully pursued (5).

The second level of empirical information is that of specialized projects of practical research. Bring to mind the evaluation-research of concrete educational processes, undertaken by order of the teacher or agency, directly responsible for this education. Such projects of practical research can provide a most useful empirical basis for simulation-models. In order to provide more than an incidental insight, however, they should be designed with sufficient compactness and detail. Certainly as soon as the results of such a research have been put into a data-bank, secondary analysis can create and preserve a most useful reservoir of empirical data.

Empirical research with a theory-building purpose makes up the third level. A difficulty here is that, so far, sociology and other empirical social sciences are far from being equipped for describing dynamic social systems. One single inquiry, or a panel in three or four waves, are inadequate approaches in this respect.

Participating observation has too limited a scope. Document analysis has been little applied up to now. Elsewhere we have elaborated which developments are needed with regard to observation-instruments (6).

If we want to arrive at an adequate simulation of the university system, we shall have to arrive at collecting data on all three levels, and that well interrelated. On the first level "monitoring" on a number of core-indicators is necessary, and that in such a fashion, that developments in time can be reconstructed. On the second level it is important that results are well tuned to each other (as to time, qua shape by standardizing). Also a good central depositing of results is of importance. The third level requires a carefully chosen number of mutually harmonized projects of theory-building research and of development of instruments for description, analysis and systematical change.

In fact these wishes to achieve a better empirical basis are directly related to the desirability of a good research-policy to the study of the university system.

3.4 Validity and Usefulness

So far rather little research has been done into the validity of models for simulating university systems. In a field where simulating has been done for some time already, i.e. the study of international relations, evaluation-research has taken place on a large scale, and is still going on. In the years to come, also regarding university simulating, the validity of models will be taken into consideration.

An important aspect of this validity research is, whether the models can make useful, empirically justifiable predictions. Predictions are, both from policy - and from a theory-building point of view, most interesting. It would already be of importance, if the predictions could reach the modest level of consequence-analyses.

This situation leads to the conclusion, that interesting results may be expected from research, where consequence-analyses of university systems and the changes therein are performed with the help of man-models and man-computer-models; in a later stage also computer-models. Such consequence-analyses can be validated by reconstructing in simulation, the processes which actually took place, but are unknown to the participants in the simulation. When the degree of validity is known, we can proceed from there to consequence-analyses with regard to new processes. Obviously these should be followed by evaluation-research, i.e. control of the predictive capacity on the basis of actual events which meanwhile have become known.

Hopkins has raised some important and plausible criticisms on the use of large simulation-models for university planning (7). To begin with he goes into the relation between the expenses of making and using the models on the one hand, and the output of the models on the other hand.

"Thus, it can be concluded that the collection and processing of data for a cost-simulation-model requires a major investment of time and money. Just how large an investment is difficult to say, for this depends on many factors that are unique to each institution. However, based on the author's experience, the total costs of developing and implementing a simpl CSM is on the order of $75,000 spread over a period of two to three years. Data-related tasks account for approximately two-third of this total. The most sophisticated CSM's have many added software and analytical features that make the orders of magnitude more expensive. For example, the CAMPUS models, designed as interactive computing systems, have cost more than $1,000,000 to develop and implement.

To the implementation cost of a CSM one must add an estimate of the cost of using the model to perform analyses. For the simpler versions, this probably amounts to approximately $15,000 per year in analyst, programmer, and computer time, provided that the model is used year after year with the same data basis. However, because the parameters of the model are known to change from one year to the next, it has often been recommended that the data base be updated annually. In this case, the annual operating costs might well be doubled."

Next, Hopkins goes into the movements of the parameters. The desirable proportion of teachers as against students turns out to vary per institution an faculty as much as 200% from one year to the next. In such circumstances a large computer-model with few possibilities to change parameters etc. during the run is not a very practical aid. Hopkins' final conclusion can also be important for our argument. He states:

"...based on cost considerations alone, the author would argue that the use of mathematical models for making resource projections at the departmental level is simply not appropriate. The cost of new educational programs can be predicted far more directly, inexpensively, and accurately if we use the judgment of experienced educators to estimate the student demand for courses, the numbers of faculty that will be required to teach those courses, and the extra staff and supplies that will be needed to support that faculty. Research efforts in university planning would be better invested in attempting to understand the order-of-magnitude effects of proposed policy changes on various indicators of system performance. For example, the author has found simple models to be both useful and economical for analysing the overall effects of drop-out rates, enrollment ceilings, and other campus constraints on degree output rates; and for describing the relationship between the unit costs of outputs and such variables as student attendance patterns and aggregate teacher-student ratios. In the author's experience, a model with only 10 to 20 decision variables can be far more instructive than the large-scale models discussed in this paper. Thus, by embarking on less ambitious (but not less important) studies, we stand to learn a great deal more about the factors which influence the costs of university operatins and how these may best be controlled."

So far we know nothing about the validity and usefulness of models for education on university systems, for instruction with regard to these systems, for heuristic, plan-making, and systematically changing tasks. Evaluation-research is a must here. An endeavour at usefulness-analysis was made in the previous paragraph where, in connection with the OECD-model, we put in a plea for developing a game specific of a given country, and for playing the game with skilled planners. The former proposal is not very spectacular, but the latter is of great importance. What do specialized skilled educational planners make of university simulation, and what remains intact of such models (8)? Generally we may assume, that the usefulness of university simulation models will be about equivalent to the usefulness of simulation in fields such as physical planning, administrative service etc.

3.5 Final Remarks

We have reviewed three problematical aspects of developing a university simulation. Of course there are other difficult aspects. Finally, in order to avoid giving too optimistic an impression, it may be desirable to mention briefly a few more bottlenecks.

The theory for the foundation of the models is far from perfect. We do not mean to say that there is a lack of speculative pronouncements on the functioning of the university or on a desirable future thereof. On the contrary. The academic revolution has induced hundreds of university-citizens to publish dissertations on past, present and future of this institution. The hypothesis of equality, the democratic form of government, the mass university education, the menace to the pursuit of science, to each of these considerable attention has been paid by newspapers and periodicals, professional journals, on T.V., and, orally, in discussions. So there hardly is a lack of hypotheses, although not yet enough inventive thinking has been done about better solutions. But there is a great lack of clear-cut opinions, accurately confined to their range in time and space, bearing a note on their empirical basis, and related to the theoretical statements on the university in general.

The lack of useful theory will make itself more felt in the years to come. As soon as the empirical basis will have become stronger, and as soon as simulation in the field of university decision-making will become more generally adopted, the call for good theory will become louder.

Is the building of models and the data-processing by means of computers a problem? There is an excess of models for the analytical application of simulation which can serve as an example. In this case the computer hardly causes difficulties. There still is a lack of useful basis-models for the educational, heuristic application of simulation for many possible tasks. F.i. instructing participants in a game still is a technicall backward field.

4.0 CONCLUDING REMARKS

The processes of structural change, that affect the university systems in most countries, make a number of large scale policy measures necessary. These measures have to include the application of models like analytical simulation and gaming, because the scope and impact of the reorganization make traditional policy instruments inadequate.

A handicap for an optimal use of simulation in the university system is, that the scale on which development and evaluation of such models should take place, can only be used exemptionally. The progress made in large, specialized institutions in the U.S. and in Western Germany, working with teams of 30 to 60 specialists, illustrates the desirability of an ample scheme of manpower, equipment and financial resources. Also the availability of specialized researchers and designers contributes a bottleneck, as university department offering advanced training in these fields are scarce.

Models have to be developed and evaluated, they have to be implemented systematically to. In both the U.S. and Western Germany organizations have been created, that provide departments etc., as to the application of models to special problem areas. University simulation is dependent on a number of other areas of scientific activities. Especially the development of consequential analysis may be considered of crucial importance of the development of anlaytical simulation. Gaming constitutes a second general input area.

On the other hand the simulation of university systems might also provide simulation in general with a number of new aspects. The development of the university system especially in the last five years has been documented in a very intensive way. This creates the possibility to use techniques like post-diction to analyze and re-enact processes in this system.

The author is engaged in a research project, in which a number of simulation models of university systems are developed. The project is financially supported by the Netherlands Foundation for Educational Research. It is carried out at the Department of Sociology, University of Utrecht, 2 Heidelberglaan, Utrecht, The Netherlands.

NOTES PARAGRAPH 1

(1) a.o. Chr. Jencks and D. Riesman, The Academic Revolution, New York 1968.

(2) "Simuleren van universitaire systemen", Utrecht, April 1973, Dutch version only.

NOTES PARAGRAPH 2

(1) O.E.C.D., Directory of Current Educational Models in OECD Member Countries, Paris 1969.

(2) G.B. Weathersby en M.C. Weinstein, A Structural comparison of analytical models for university planning, Berkeley 1970.

(3) O.E.C.D., Study of one mathematical model of the education system, Paris 1969, also: Tore Thonstad, A Mathematical model of the Norwegian Education System, in O.E.C.D., Mathematical models in educational planning, Paris 1967.

(4) Werkgroep-De Vries, Numerieke gevolgen van de voorgestelde herstructurering van het wetenschappelijk onderwijs, Den Haag 1971.

(5) M. Albinski, J. Geurts en F. Schute, Studentenstop: verschuiving van problemen, Nijmegen 1972.

(6) R.S. Johnson, NCHEMS student flow model, Boulder 1972.

(7) Systems Research Group, Campus Planning Model, Toronto 1973.

(8) H.W. Frey, Untersuchung des Personal-und Raumbedarfs im Fach Anglistik mit Hilfe eines Simulationsmodells auf EDV-Basis, Weinheim 1972.

(9) A. Hage e.a., Geofak, Untersuchung des Geowissenschaflichen Fakultat des Universitat Freiburg, Hannover 1972.

10) J.L.M. Gossens, Development of a model for some aspects of university management, Paris 1971.

11) J.A.M. de Nie, Total University Simulation System, Utrecht 1971. (mimeogr.)

(12) D.J. Warren Piper en J. Race, Maddingley Game, Cambridge 1969.

(13) Abdul Khan en P. Levasseur, The Use of 'gaming' as a technique for training educational planners, The OECD Observer, No. 39 April 1969.

(14) Abt Associates Inc. Edplan, Cambridge, Mass. 1970.

(15) Frank Zilm,Outlines and development of two games of university planning, Michigan 1971 (mimeogr.)

(16) J.A.M. de Nie, Simulatiespel tertiair onderwijs, Utrecht 1972 (mimeogr.)

NOTES PARAGRAPH 3

(1) See f.i. B.S. Bloom, J. Th. Hastings and G. F. Madaus, Handbook on formative and summative evaluation of student learning, New York 1971.

(2) See note 2, paragraph 2.

(3) B. Lawrence, G. Weathersby and V.W. Patterson (eds.), Outputs of higher education, their identification, measurement and evaluation, Boulder 1970; also D.W. Breneman and G.B. Weathersby, Definition and measurement of the activities and outputs of higher education, Berkeley 1970.

(4) H.W. Peters, System of indicators and criteria for measuring the efficiency of planning and management, Paris 1972.

(5) See notes paragraph 2.

(6) H.A. Becker, Observation by informants in institutional research, Quality and Quantity, Vol. VI, 1972, No. 1.

(7) D.S.P. Hopkins, On the use of large-scale simulation models for university planning, Review of Educational Research, Vol. 41, 1971-1972.

(8) Abdul Khan and P. Levasseur, o.c.

THE DATA BEHIND SIMULATION MODELS

H.A. Becker
Department of Sociology
University of Utrecht
2 Heidelberglaan, Utrecht
The Netherlands

1. INTRODUCTION

The majority of those who are developing or using simulation models are dissatisfied with these models. We find the reasons for this dissatisfaction as soon as we try to predict with analytical simulation models, or teach and instruct with gaming models. Each type of simulation has its weak spots. Quite a number of causes could be listed for the inadequacy of most of our models.

In this chapter we shall look at the hypothesis, that the explanation for the inadequacy of simulation models in the social sciences is to be found primarily in the weakness of the data behind the models. We shall consider in this chapter also, to what extent there are opportunities to find a way out of this deadlock.

2. SIMULATION

In order to establish a basis for communication, we first shall have to define a number of our terms. In social sciences we are interested in social reality and especially in regularities in this reality. Sometimes these regularities take the shape of systems. A system is characterized by two or more identifiable parts, by an interdependency of these parts and by system boundaries. If we have just a number of unrelated processes or only a number of social positions we do not speak of a system. Social scientists are confronted as a rule with dynamic systems. As systems are often quite complicated entities, we necessarily begin by introducing various simplifying assumptions which enable us to represent the real system by an abstract model which makes description, manipulation, etc. easier.

The models may be static or dynamic. A static model, like a map of a city, represents a situation, but not a process; in dynamic models the element of time in included. These latter models depict developments, e.g. by showing the phases of processes. We call dynamic models of dynamic systems, showing a certain degree of complexity, simulations.

The term "simulation" is used to indicate a miscellaneous collection of models. If we want to have an organized discussion about these models, we will have to start with a classification. For this purpose we need a multi-dimensional classification.

Our first dimension deals with the instrumentation of simulation models. We distinguish between computer-models, man-models and man-plus-computer models. In the case of a computer model an analyst orders a computer to process some information, an arithmetical problem for instance. During the processing of the information man does not interfere with the operation of the computer, and therefore this model is called (quite inadequately) a computer model. In man-models the processing of information is done by the participants in the model. In man-computer-simulation the participants and the computer take turns in processing the information. This dimension has almost no theoretical relevance, and therefore it is inadequate as a prinicpal basis for the categorization of simulation models.

The second dimension deals with the potential functions of simulation models. They can be used for analytical purposes. In theory-building research we are interested in an analysis that results in propositions that have a high degree of verification plus a high degree of abstraction. In practical research a high degree of verification is desirable also, but now a low degree of abstraction is sufficient (statements about the developments in a single organization for instance). Simulation models can be used also for education; training, etc. in schools, universities, during in-service training in organizations etc.. We can use them to facilitate the development of plans for future action. Still another potential function is planned change of attitudes, perspectives, habits, etc. of participants in a simulation (function of change agency).

The third dimension is closely related to the second one. Now we look at the nature of the simulated processes. Allocation processes are adequately analyzed as flows of entities through "channels" during a certain time period. Production processes are flow models too, but now we record change with regard to the entities themselves (production) during the advancement of the entities through time. We use an interaction model, if an adequate representation of the reference-system demands the inclusion of interaction between entities. In general allocation and production models are restricted to analytical simulation.

Our fourth dimension is terminology as it is used at present. This terminology is quite confused, especially because it tries to take different dimensions into account without distinguishing between them (for instance heuristic simulation, simulation of heuristic processes, heuristic gaming, heuristic gaming-simulation mean different things). In our opinion the best strategy to arrive at a uniform and practical terminology would be to get a careful description of the most important terms now in use, and to develop a uniform multi-dimensional classification to match the terminology. We distinguished four dimensions, but it may be necessary of course to add more dimensions.

We shall not enter the Babylon of terminology in simulation much further. In diagram 1 we present a classification of simulation models by terminology, instrumentation and potential functions. In diagram 2 we develop this classification a bit further. Elsewhere we have given a detailed account of the references, arguments etc. behind this classification (1).

3. THE EMPIRICAL BASIS OF OUR MODELS

3.1 A model of model-building

When designing and using simulation-models the necessary steps are, in an arbitrary time sequence:

1) What is my problem? What is my target? Do I have to develop a model at all?
2) What are the components of the model in construction?
3) What theoretical, philosophical etc. notions do I have to incorporate?
4) Which data do I need?
5) How do I develop my model, how do I test it? How do I implement it?

The comparatively elaborate venture of developing and implementing a simulation model is only necessary if the characteristics of the system and the characteristics of the objective demand such an approach.

The main characteristics of the system that demand this approach are: complexity, dynamic structure, institutionalization or combinations of these characteristics.

The main characteristic of objectives that demands this approach is the wish to make the model highly complex, highly dynamic, highly valid as to institutionalization, etc.

3.2 Characteristics of social systems

As a rule social systems have a relatively low degree of regularity, and therefore they have a relatively low degree of predictability (2). Manipulations like policy measures may force a system to become a bit more regular or a bit more irregular, but the basic characteristics of low regularity remain.

Nevertheless we need predictability, because we want the advantages of a scientific approach in analysis, teaching, instruction, planning, planned change etc.

If we want a valid model of a system, the model cannot contain more regularity than the system itself. It is possible, however, that a new look at social systems might disclose new aspects of the phenomenon of regularity.

Our first opportunity for a new perspective lies in distinguishing between periods with relatively high predictability and periods with relatively low predictability.

Let us look at an example. Often during policy negotiations the policy-maker has quite a number of alternatives at his free disposal. In this period predictability of the system might be relatively low. As soon as the policy-maker has made his decision and the effectuation of the new course has started, we get a period of relatively high predictability.

A second opportunity lies in the introduction of a concept of alternative pasts. If periods of low predictability are characterized by a number of alternatives, an analysis of the consequences of certain developments could legitimately include a number of possible courses in the past. The concept of alternative pasts could be useful when we turn to post-diction.

Of course this list of opportunities does not pretend to be a complete one.

3.3 Data-Collection

If we want models that describe a system in its complex, dynamic and institutionalized aspects, we need data concerning that system that permit such a description.

Sometimes we can use information that is already documented. Content analysis of documents in international relations is able to provide a data basis that is superior to the basis normally available in the social sciences.

As a rule we have to obtain new data. The traditional approaches (survey, panel, participant observation) are inadequate at this point. New approaches will have to be developed, that have a number of merits of both survey and participant observation, but that lack a number of their drawbacks. The new techniques of data collection should have the following characteristics:

a) an over-time data gathering. The development of models of dynamic systems requires registration over a period of a month to a few years. To give an example: a question in a survey as to what a respondent remembers concerning the events of the past week will not produce enough information.

b) gathering data as "unobtrusively" as possible. For example, a single direct questioning would certainly yield unreliable data.

c) a data collection which can be applied on a large scale; in order to bring forward regularities of a somewhat general character one must be able to compare, if necessary, hundreds of cases.

Our first example of such kinds of intensive data collection is the "eductive" simulation, developed by Rome and Rome. They register the growth of an organization through decisionmaking. The organization is simulated in a laboratory by means of a gaming-simulation (3). This approach could be used, we presume, as a technique of intensive data collection as soon as its results could be evaluated, for instance by means of postdiction.

A second example is the use of "informants". These informants observe the system according to instructions provided by the research team. The informant-observer will gather and pass on to the investigator data about what takes places within his "scope". This can be their own conduct, the conduct of persons in their immediate surroundings or activities in bordering social systems (4).

As an example we take higher education as a dynamic macro-system. A part of this system, that would be of a size to permit research, could consist for instance of five faculties, some related research-institutes outside the university and the part of the government-department, that is actively involved in the policymaking with regard to these faculties etc. The functioning and the interaction of these organizations could be registered by for instance five to ten informers per organization, keeping a record during a period of for instance three to five years. In combination with a.o. analysis of written documents such a technique of data-gathering is capable of providing highly valid and detailed information.

3.4 Intensive and Extensive Data-Collection

As a rule the scope of intensive data-collection is subject to marked limitations, for instance that of financial character. However, proceeding on intensive data-collection, a complementary extensive data collection can be brought about. Data-collection on a number of levels can result in a powerful combination.

4. VALIDATION AND APPLICATION

How do we make sure that the data have an optimal degree of validity? How do we make sure that they describe the system in all its relative regularity and predictability?

4.1 Post-Diction

The technique of post-diction has not been used much in the social sciences yet. It is applied in economics, and in the analysis of international relations (5). Why has it been used to such a small extent in the social sciences? Perhaps the reason lies in the insufficiency of the available data. If this situation improves, the problem of validation will become less severe. The results of the post-diction can be evaluated if and when we use a differentiated interpretation of regularity (see 3.3).

Today, a subject area that could be approached with the technique of post-diction is higher education. The development of a university, a faculty, or a department can be reconstructed to quite an extent on the basis of written documents. The system of higher education shows a certain degree of democratic control, and therefore a certain degree of openness. We need additional data, but these can be obtained with no more difficulty than we are normally confronted with in social research.

4.2 Consequential Analysis

Consequential analysis may be considered as a prediction containing many conditions. If consequential analysis is employed in a field in which this type of prediction has been used and validated (e.g. by post-diction) on a regular basis, its results may be extremely relevant, especially from a practical point of view.

4.3 Anlaytic, Educational and Heuristic Functions

Not only analytical models but educational and heuristic models, too, should demonstrate a high degree of validity in order to be useful.

Educational models provide the student with an abstraction of a system he will have to deal with later. If this model does not contain the main characteristics of the social system it describes, the educational process is bound to be less than optimal. Of course we "distort" reality in educational models, for instance by changing the time-decision. But how can we design an adequate educational model with an optimal "distortion" of reality without knowing this social reality to an adequate degree of detail and validity?

4.4 Theoretical and Operational Levels

In the empirical sciences (including social sciences like political sciences or sociology) we distinguish between statements or propositions on a theoretical level and on an operational or experimental level (6).

Propositions on a theoretical level have a relatively high degree of abstraction. They cover a great number of phenomena, that may differ with regard to time, location, etc.

Propositions on an operational level are restricted to phenomena of a relatively low level of abstraction. They contain statements that give information on a relatively high level of verification. To meet this standard of verification they are confined as a rule to objects that have quite narrow limits as to time and space.

Theoretical propositions cannot be confirmed empirically in a direct way. They have to be "translated" into operational statements, and their confrontation with social reality (attempts to falsification) takes place on the operational level.

Analytical simulations that aim at a high degree of empirical validity have a tendency to keep to a low level of abstraction. A model in the field of international relations simulating the development of one international conference on disarmament may be able to predict (by post-diction for instance) some characteristics of the phases of this conference. Maybe in the long run the level of abstraction of models like this can be increased a bit. But a predictive model of "the" contemporary international negotiation, or of the development of "the" middle-size town in the United States or in Europe is an utopia. General analytical models are like theories: their "predictive" power is limited. We must translate their general statements into operational statements, that can be put to a test in experimental situations.

The difference between theoretical and operational models has consequences also for the use of simulation in the field of education and training. Education aims at a general preparation of the participants (students etc.) for a great variety of activities. This implies, that educational models cannot have a high degree of direct predictability. Their validity is examined by testing operational statements that have been derived from the general statements. Training has a different perspective. It aims at preparing the participant for a restricted set of activities. Simulation models developed for training purposes show a low degree of abstraction. Therefore, their "validity" with regard to their reference-system can be determined in a much more direct process of verification.

The problem of the data behind simulation models is located at the operational level of this model. But of course the theoretical level is involved also, especially as soon as theoretical models have to put their statements to an empirical test after they have been "translated" into operational statements.

5. CONCLUDING REMARKS

Our essay puts forward a number of hypotheses:

a) in the development of simulation models the data constitute the most serious drawback;

b) we have to reconsider the regularity and predictability of social systems;

c) we have to develop and use new approaches in data collection and in validating the obtained data; some new approaches are available;

d) better data will provide us with better conditions for post-diction and consequential analysis;

e) the empirical basis as a weak link in the development of simulation models does not only affect analytical simulations but educational and heuristic simulations also.

If the empirical basis does indeed constitute the weakest link in the chain of model building, improvement of this basis should receive high priority. This might comple the simulationists to expeditions into fields which they at present leave mainly to others.

DIAGRAM 1 CLASSIFICATION OF SIMULATION-MODELS.

instrumentation	terminology	potential functions				
		theory-building research	practical research	education, instruction	heurstic, planning	change agency
a) computer	computer-simulation, (all) machine simulation	xx	xx	-	-	-
b) man	game; (all) man simulation	x	x	xx	x	xx
c) man plus computer	gaming-simulation man-machine simulation	x	x	xx	xx	xx

x=limited use
xx=frequent use

DIAGRAM 2 CLASSIFICATION OF SIMULATION MODELS BY INSTRUMENTATION AND NATURE OF THE SIMULATED PROCESSES.

instrumentation	allocation processes	production processes	interaction processes
a) computer	xx	xx	x
b) man	-	x	xx
c) man plus computer	-	x	xx

x = limited use xx = frequent use

1) This essay has been financially supported by the Netherlands Foundation for Education Research as part of a research grant for a project, in which a number of simulation models of university systems are developed. The author is working at the University of Utrecht, Department of Sociology, 2 Heidelberglaan, Utrecht, The Netherlands.

2) References, arguments etc. in general introduction to H.A. Becker and H.M. Goudappel (eds), Developments in Simulation and Gaming, Meppel 1972, and H.A. Becker, Simuleren van universitaire systemen, Utrecht 1973.

3) Predictions ultimately have to include explanation (E. Nagel, The Structure of Science, London 1968), not only extrapolation of trends. Predictions may contain clauses (like a maximum and a minimum). They must be relevant in a theoretical or practical sense. (A prediction with too wide a margin between a maximum and a minimum is irrelevant.)

4) B.K. Rome and S.C. Rome, Organizational Growth Through Decisionmaking, New York 1971.

5) References, arguments etc. in H.A. Becker, Observation by informants in institutional research, Quality and Quantity, VI (1972), no. 1.

6) H. Guetzkow, Some correspondences between simulations and 'realities' in international relations, in M.A. Kaplan (ed.), New Approaches to International Relations, New York 1968. "Post-diction" means starting in the past (five years ago for instance) and "predicting" developments up to the present time. This developments are presumed to be known. If post-diction proves to be possible, the model has shown to have a (very limited) degree of validity. The model can be used now a.o. to predict future events also, if a number of conditions are made explicit.

7) See a.o. E. Nagel, o.c.

SIMULATING ALTERNATIVE FUTURES FOR AMERICAN EDUCATION

by Jerry Debenham
University of Utah
Cultural Foundations of Education
Salt Lake City, Utah 84112

This paper is a report on the development of a completely computerized simulation-game of the future of American education called SAFE (an acronym for Simulating Alternative Futures in Education). The game models the short- and long-range impact on society of decisions which educational leaders might make with respect to possible social, educational and technological developments from 1975 to 2024 A.D.. Following an introduction to the game, this paper states the game's specific learning objectives, briefly reviews the related literature, outlines the game procedures, suggests alternative preparation and playing techniques, and gives tested application ranges and costs. Finally, it provides a sample run of the game, a summary of developmental trial-runs and an outline of needed further research and development.

INTRODUCTION

Imagine yourself in this situation. The year is 2005 A.D.. You're a public school district administrator. You have just implemented a program which makes advanced intelligence drugs available to all citizens in the community. An unanticipated minority has become rebellious as advanced reasoning and memory powers qualify numerous citizens for professional training and jobs which the society cannot provide. Lawsuits are initiated by conservative groups demanding the discontinuation of usage of the drugs. The teacher's union has decided to strike if intelligence drugs aren't prohibited in the schools. Radicals threaten a revolution if their free distribution is discontinued. The federal government hesitantly promises to back you if you maintain the program.

This is just one among an infinite number of possible scenarios which can occur in the simulation-game SAFE. The game is the product of several year's effort at synthesizing the growing body of futurist literature in education into a meaningful classroom learning experience for students of social change. It has been recently used in courses in Education, Educational Administration, Educational Research, Sociology and Social Work at the University of Utah.

LEARNING OBJECTIVES

The simulation-game SAFE is designed to help participants reach the following specific objectives:

* Participants will learn a wide range of future educational alternatives which can be anticipated to some extent from generally foreseeable developments in American society.

* Participants will learn new techniques and approaches now emerging to facilitate meaningful long-range planning.

* Participants will learn a model for studying the interrelationships between schools and society and the consequent restraints on the powers of educational decision makers.

* Participants will develop an increased sensitivity to the values of various socio-political groups.

* Participants will deliberately examine a variety of viewpoints on controversial issues about the future with the intention of establishing informed opinions about them.

* Participants will demonstrate faith in the power of reason and in analytical methods to foresee and build a more viable future.

* Participants will weigh alternative educational policies against the standards of long-range overall public welfare rather than short-term or special interest groups.

* Participants will judge problems and issues in terms of situations, purposes and consequences involved rather than in terms of precepts or emotionally wishful thinking.

* Participants will seek to integrate the future perspective into their personal philosophy of education.

* Participants will show increased confidence in their own and their society's ability to deal with a rapidly changing world.

RELATED LITERATURE

The potential of simulation techniques for professional training in education, despite rapid advancements in other fields, remains relatively unexploited. Where it has been developed and used, such as the UCEA's "Madison Township Schools," [1] the focus has been on administrative in-basket programs and not the dynamics of school-society interrelationships.[2] Only a very few attempts have been made for using computers in the simulations.[3] None have been used widely and most are prototype models of the in-basket manual games.

SAFE employs a model of the interrelationships between schools and society based on the general Getzels-Guba model of administration as a social process[4] and the general theory of the systems approach to benefit-cost accountability decision making popularized in the PPBS techniques of district budgeting now rapidly spreading in the United States.[5] The general theory of the interrelationships between education and society, it is recognized, is "in the infancy stages." Most of the specific dynamic interrelationships in SAFE are postulated strictly for the purpose of building the simulation. The game does not attempt to predict real educational developments of the future nor their impact on society, but undertakes only to open the imagination to alternatives and the need for gathering extensive reliable social statistics until truly sophisticated, accurate systems models of predictive value can be constructed.

The game's development was heavily influenced by three other simulations relating to the future of society: "STAPOL," by Dennis L. Little, et.al.,[6] "Delphi," by Stuart Umpleby and John Briggs,[7] and "Future," by the Kaiser Aluminum Corporation.[8] The interrelationships and alternatives in the game were developed through such futurist techniques as delphi, cross-impact matrices, scenarios, and future-history analysis.[9]

The general outline of economic, social and value trends over the fifty years is primarily based on the work of Kahn and Wiener,[10] and the alternative educational viewpoints concerning how schools should be operated was heavily influenced by the work of Pounds and Bryner.[11] The development of the sixty innovative programs presented in the game is based on a review of the general education literature and specific delphis and futurist studies which have predicted technological, biological and social changes over the next half century of significance to educators.[12]

GAME PROCEDURE

In its mechanics, SAFE centers upon the interplay of five basic elemented:

District Innovation Planning Committees develop operating and planning programs within the constraints of a designated operating budget. Their objective is to maximize overall social satisfaction with public schools.

Edvents are general proposals for change in the educational system. Two new edvents occur during each two-year planning period and their implementation by the district affects the socievents and the indices of satisfaction.

Socievents are general classes of social developments (such as GNP growth, student riots, teacher strikes) of financial importance to educators and which occur on a probability basis that may be affected by the various edvents and in turn, affect the indices of satisfaction.

Educational Evaluators are socio-political interest groups which actively represent alternative viewpoints concerning the best aims and methods of education. They determine the impact of district decisions upon the indices of satisfaction.

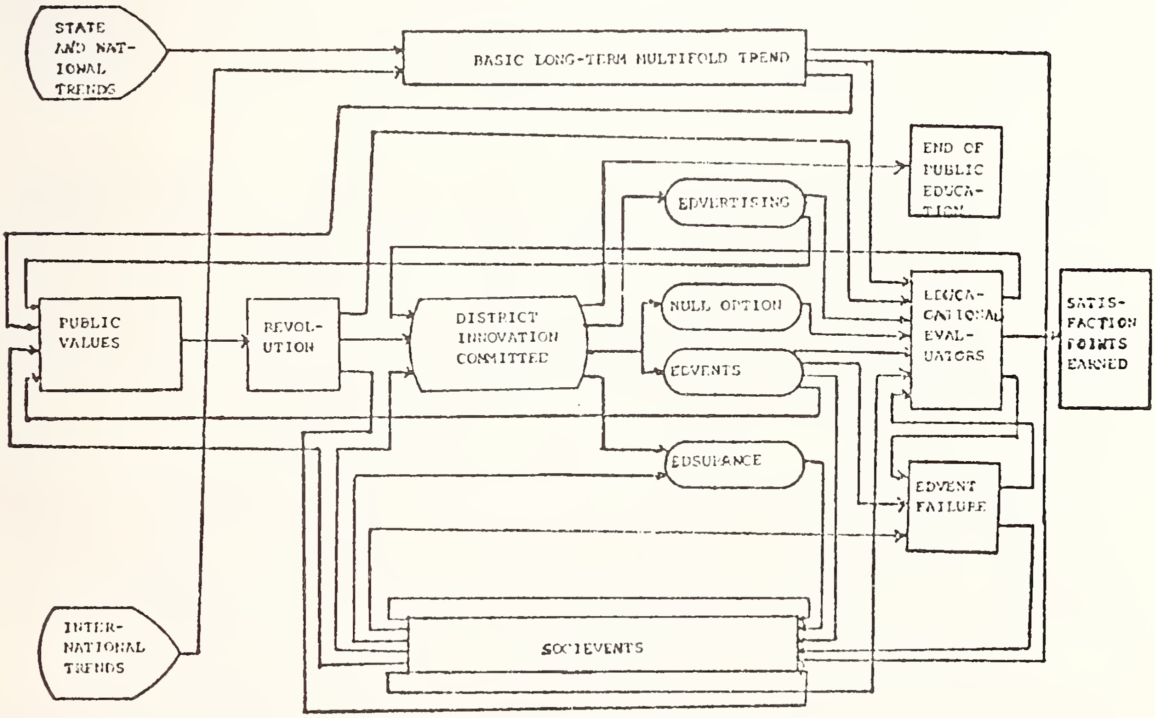
Indices of Satisfaction are social indicators of the degree of relative change in satisfaction with public education by each of the seven educational evaluators.

Each participant in the game represents an important community leader and is part of an innovation planning committee for a large metropolitan district. There are one to ten other districts in the state called STATOS. The committee task is to please the evaluators over the long-run more adequately and consistently than any of the other districts. If it can do this, it can win more satisfaction points than any of the others by the year 2024 and becomes the winner.

FIGURE I

FLOWCHART OF INTERACTIONS BETWEEN THE

DISTRICT INNOVATION PLANNING COMMITTEE AND THE WORLD



Every two years the committee receives 12 million STATOSDOLLARS in tax revenues above normal operation and maintenance funds to use as it pleases. If the district goes into debt, it is charged interest. If it saves a surplus, it earns interest. If the debt goes beyond 30 million, tax revenues are increased, but satisfaction points are lost and the probability of a conservative reaction goes up. If the surplus exceeds 30 million, tax revenues are decreased and satisfaction points are won.

The committee has three ways to affect its world, a role played by the computer; through edvents, edsurance and edvertising. Figure I is a flowchart showing these alternatives and the locus of their effects. The main way is through the purchase of edvents. These are sixty major proposals for educational reform in STATOS. Table III briefly summarizes 20 of them. Up to 18 of these edvents may be available as options from which the committee may choose at any given time. The committee task is to select that edvent among the options which will win it the most satisfaction points for the present, have the least undesirable long-range consequences, and is least expensive after dividing the benefits by the costs.

There are numerous conflicting points of view concerning the goals of education in STATOS which may be summarized in seven general value positions given in Table I. And there are corresponding socio-political groups, called the educational evaluators, who control all major educational decisions. Every edvent has some evaluators who favor it and others who oppose it. The evaluators, however, do not necessarily represent the public in the district. The difference between the percentage of influence the evaluators wield over educational decisions, and the percentage of citizens who support these positions is called the Gap. If the gap gets too large, a revolution may occur.

The number of points a committee may win by the implementation of an edvent is determined by summing the product of the influence levels and the degree to which each evaluator favors or opposes the edvent (on a scale from -3 to +3). For example, if the Essentialists control 32% of the power and are rated moderately in favor of an edvent (+1 on the scale), then they offer the district 320 satisfaction points (320 x1) if it is implemented. If the other evaluators, however, are against the edvent, all total the district may still lose points.

Whatever decision the committee makes, it will have definite far-ranging consequences. When an edvent is implemented, in addition to the points it may win or lose the district, it increases the influence levels of the evaluators who supported it and decreases the influence of those who opposed it; that is, if the edvent is a success. It changes the probability of occurrence of many if not all of the 12 socievents. It also has cumulative long-range effects upon the values of the public.

Unfortunately, not all edvents are successes. The success or non-success of an edvent is dependent upon the extent to which teachers, students, parents and administrators will support its implementation and the degree to which it was a good choice in terms of short- and long-range consequences. When an edvent fails, the influence changes anticipated with its success are reversed and only half the satisfaction points are earned.

There are many evaluators in STATOS who are threatened by most changes which occur in education and generally speaking, are most pleased when the only change that occurs is a reduction in taxes. The decision to avoid all change is called the Null Option in SAFE. Though it costs nothing to implement, it has far-ranging effects upon the influence levels of the evaluators, values of the public, and the probability of occurrence of the socievents.

TABLE I
BRIEF DESCRIPTION OF THE EDUCATIONAL EVALUATORS

1. Neoperennialists: This group believes in a fundamentally unchanging universe. Schools are responsible to teach the essentials of the protestant ethic. The trend toward the expansion of school responsibilities is to be reversed. Influence level: 8%

2. Essentialists: This group believes in a slowly evolving world. Educators are to transmit only those cultural elements that have become thoroughly established (support the status quo) and integrated into the national heritage. Influence level: 32%

3. Social Realists: This group believes it is the job of the school to keep up with social change and adjust to the needs of the society. It believes in moderate expansion of the schools and opposes any programs which might weaken the influence of public education. Influence level: 25%

4. Experimentalists: This group believes the purpose of education is the development of critically-minded individuals capable of seeking and finding creative answers to the problems they face in society. It favors considerable student freedom. Influence level: 12%

5. Social Reconstructionists: This group believes the purpose of education is to develop individuals with the ability and desire to create a better social order along the lines dictated by current social knowledge. Influence level: 12%

6. Human Potentialists: This group believes the purpose of education is the expansion of consciousness and the provision of experiences which promote individual self-actualization. It promotes almost unlimited student freedom. Influence level: 10%

7. Biological Reconstructionists: This group believes the ultimate purpose of education is the promotion of the biological transformation of man. It promotes all programs which help man control or transcend his primitive instincts or capabilities. Influence level: 2%

Every decade has a general value trend toward degrees of conservatism or liberalism which results from national and international developments. The most common trend of a decade is toward moderate liberalism (egalitarian, epicurian, meritocratic) which extends back in STATOS history for 5 centuries. Although the districts have no control over the general long-term or specific short-term trends of the society, they can affect the 12 major social events which might occur during any two-year period. These 12 events are briefly described in Table II below. During every two-year period the computer generates a random number between 1 and 1000. If this number is greater than the probability of occurrence for a socievent, it does not occur. If it is equal to or less, it does occur. The occurrence of a socievent, like the implementation of an edvent, also has multiple far-ranging effects. First, its occurrence may increase or decrease the probability of occurrence of itself in the future and each of the other socievents. Second, it may change the influence levels of the educational evaluators and the values of the public. Third, it may radically affect the income of the district both positively and negatively.

Participants can partially control the occurrence of socievents through edvent selection or the purchase of edsurance. Edsurance is the second way the committee may affect its world and consists of a series of programs which may range from community-school interaction groups to the establishment of emergency funds. Its purchase reduces the probability of occurrence of negative socievents (with the exception of nuclear war or revolution) by two-thirds.

Revolution may occur in the district if the gap between evaluator influence and public values gets too large. This means that district leaders have been ignoring the needs and interests of significant segments of society which now constitute a powerless, alientated minority. If a revolution occurs, it may succeed or fail. But in either case, like edvents and socievents, it has far-ranging effects upon the society. [13]

TABLE II
BRIEF DESCRIPTION OF THE TWELVE SOCIEVENTS

Socievent	Description	Cost	
1.	National GNP growth results in a tax increase	SD	+2.225 M.
2.	Greater efficiency in school administration	SD	+2.625 M.
3.	Increase in community involvement and concern	SD	+8.625 M.
4.	Greater national interest and funding	SD	+6.750 M.
5.	Conservative reaction by politicians	SD	-4.250 M.
6.	Parent boycotts and suits over changes in schools	SD	-3.500 M.
7.	Teacher strikes and sabotoge	SD	-4.500 M.
8.	Student riots, protests and vandalism	SD	-4.250 M.
9.	Sudden increase in student population	SD	-3.500 M.
10.	Accidental school disasters	SD	-5.000 M.
11.	Redirection of resources from schools	SD	-6.250 M.
12.	Limited nuclear or other social disaster	SD	-125.000 M.

Edvertising is the third way the committee may affect its world. It consists of a series of techniques ranging from public advertising and tight control over news releases to lobbying and catering to influential leaders -- all in an effort to persuade the evaluators that they should like the committee's choice much more than they seem to be inclined to like it. Edvertising is a powerful technique which can win the district more points, change the evaluator influence levels to more democratically represent the public at large, or change influence levels to correspond to the values of the district leaders. Unfortunately, however, district funds are limited and edvertising is expensive.

In summary, the district innovation planning committee has three ways of changing its world: through edvent selection, edvertising and edsurance. The computer has five ways of affecting the district: through socievents, revolution, edvent failure, control over the banks, and the basic, long-term multifold trend. The players soon realize that the computer plays a very powerful role and the committee a weak one. They never have quite enought money and the computer is always creating some unforeseen challenge to their plans. The committee task is to anticipate the short- and long-range consequences of its decisions and likely social developments in such a way that it can generally control the computer, maximize its points and outperform the other teams.

PREPARATIONS AND PLANNING

The game is designed so that participants can set their own initial values for the public, the influence levels of the evaluators, and the probabilities of occurrence of the socievents. By this technique, teams can represent districts catering to various social classes and students can model them according to their own state districts. The game is also designed so that the edvents can be rewritten and all interrelationships reworked. The computer asks the relevant questions and re-programs itself. If insufficient time is available for students to redesign the game, the computer is programmed to automatically provide a set of hypothetical values and interrelationships.

The actual playing of the game is divided into five ten-year planning periods. When participants come to interact with the computer, it takes them only ten years into the future. Then it automatically summarizes everything that has happened -- all the points the district has earned, socievents which occurred, the debts accumulated, interest charged, changes in influence levels and public values, and probabilities of occurrence of socievents and edvent failure -- and turns itself off. This information is then used to prepare policies and make decisions for the next ten-year period.

In the assignments, participants are taught to mathematically optimize their decisions by the use of three forms of analysis: delphi for evaluator effects analysis, cross-impact matrices for socievent futurist analysis, and cost-benefit for optimum selection of programs. Every decision which is implemented is immediately evaluated by the computer for each of these three forms of anaylysis. The choice is compared to each of the other decision alternatives available and ranked. During the course of the game the assignments are gradually increased in difficulty until by the end of the game, students have the necessary skill and concepts to perform all three forms of analysis, and generally speaking, consistently receive the highest praise from the computer for excellent decisions.

APPLICATION

SAFE is completely computerized on an APL direct-interaction time-sharing system which requires only a single IBM workspace of 54,000 bytes. Participants may sit down at a portable computer terminal anywhere in the nation and connect by telephone with the nearest computer facilities. The students run the terminal themselves.

The game takes anywhere from 6 to 30 hours to play depending upon how many years into the future the participants want to go and whether they redesign the initial values and other variables. Approximately 15% of the game time is for running the computer, 45% for individual preparations, 20% for small group discussions, and the remainder for class discussions both before and after the game.

The number of people who can play the game at a given time is dependent upon trained personnel and computer facilities available. However, only 10 teams can play on one terminal and one account. Optimum team sizes vary from 1 to 9, though teams up to 20 have successfully played the game. Average costs have been $3.00 for the 145 page game manual and $3.25 per team per round of the game for the computer usage.

TABLE III
BRIEF DESCRIPTION OF TWENTY EDVENTS

Edvent	Description	Cost
1.	Career Education: Proposes that educational institutions become much more career oriented through the establishment of Career Education Centers and Greater Community Talent Banks.	SD 11 M.
4.	Family Neighborhood Learning Centers: Proposes that centers be publicly financed where both children and adults can be enticed into new educational experiences.	SD 16.5 M.
7.	Televised Home Study: Proposes that distinguished scholars prepare televised study units and that students throughout the nation be allowed to receive credit in lieu of traditional classes.	SD 11 M.
10.	Experiential Learning Schools: Proposes that educators shift emphasis from cognitive to confluent or experiential learning with careful emphasis on training the emotions.	SD 8 M.

13. Education as an Occupation: Proposes that the required years of schooling be increased and that students receive significant incomes as they advance into secondary education.	SD 18 M.
16. Family Health Center: Proposes that health education be vastly broadened in concept and made available to the whole community through publicly supported health centers.	SD 13.5 M.
19. Youth Towns: Proposes that educational parks be built in slum areas and democratically organized as total youth communities with their own government, shops and student teachers.	SD 17 M.
22. Educational Experience Centers: Proposes that centers be established which simulate conditions of the past, present or future and that each school have its own farm and mountain retreats.	SD 18.5 M.
25. Future-Shock Curricula: Proposes that schools focus the curriculum on adjustment to change through the establishment of Ideatrons, Schools of Unlearning, and a Center for the Synthesis of Knowledge.	SD 16 M.
28. Marriage Training Schools: Proposes that secondary schools provide organized trial marriage experiences ranging from monogamy to group marriages.	SD 9.5 M.
31. Incidental Education: Proposes that all education beyond grade school be noncompulsory and that secondary students be provided edu-credit cards so they can live and study according to their wants.	SD 14 M.
34. Schools of Relearning: Proposes that troublesome students be sent to special schools where they are conditioned to associate undesirable acts with extreme nausea self-induced by organic implants set in the back of the skull for five-year periods.	SD 11 M.
37. Computerized Schools: Proposes that totally automated high schools and colleges be built where computers do all teaching, examining, monitoring and counseling.	SD 15.5 M.
40. Education Centralization: Proposes that all educational services be nationalized, equalized and controlled from a National Education Assembly with elected representatives from every state.	SD 6 M.
43. World Language Education: Proposes that the schools require all students to learn a newly invented international language being taught throughout the world.	SD 4.5 M.

46. Genetic Engineering Education: Proposes that students and parents be taught the value and methods of human and animal genetic engineering. SD 9.5 M.

49. Intelligent Robot Tutors: Proposes that each student be provided with an intelligent robot and that teachers take the role of monitors of the robots and ideal human types. SD 18.5 M.

52. Advanced Personality Drugs: Proposes that drugs be used on students to control sexual desire, fatigue, moods, fantasies, aesthetic perceptions, sense of pleasure, etc., if necessary, to enhance learning. SD 9.5 M.

55. Instantaneous Education: Proposes that bio-computer technology be used to impart knowledge to the human brain or to erase it instantaneously. SD 16 M.

56. World Reconstructionist Education: Proposes that a world education assembly be established to distribut knowledge, educational skills, and resources equally to all humans on earth. SD 6.5 M.

SAMPLE RUN OF THE GAME

The simulation-game SAFE takes into consideration over 1400 variables and millions of possible interrelationships. No two teams which play the game ever end it with similar power structures, public values, socievent probabilities or satisfaction points. Through use of the computer all calculations are immediately handled and the game appears simple to the unsuspecting participants. It usually takes the whole course of the game to bring them to full awareness and comprehension of the complexities of interrelationships which are constantly occurring as they play it.

Table IV contains a sample of the computer printout for the first two-year period of the game. It includes typical student responses and includes the kinds of mistakes participants often make when first playing the game on the computer. To the left are explanations of the computer statements. Many aspects of the game are not shown in this sample run (such as revolution, closure of public schools, points lost due to debts, etc.) because the initial conditions for their occurrence are not met.

TABLE IV
SAMPLE TWO-YEAR COMPUTER PRINTOUT OF SAFE

Explanation	Computer Statement

Introduction

You are about to play the game "SAFE" -- A simulation of the future of education from 1975 to 2024 A.D. You represent District 1 and are now responsible for educational decisions from 1975 to 1984.

Table IV continued

One of four possible general trends.	Beginning: 1st Ten-Year Planning Period General Societal and International Developments over this decade will strengthen values in your district favoring moderate conservatism. You are now living in the year 1975. Your edvent options are:
This list may contain as many as 20 options.	1. Career Education 2. Vouchers 3. Accountability 4. Authoritarian Schools 5. Family Neighborhood Learning Centers 6. Community Nursery Centers 7. Televised Home Study Program 8. Education as Vocational Training 9. Community Guidance and Evaluation Centers 10. Experiential Learning Schools 11. Interactional Catv Schools 12. Individualized Learning Schools
Taxes received every two years.	Your account has just been credited with SD* 12 million from tax revenues. Total deposits in your account now are SD 12 million. Which edvent would you like to implement this year? If none, Type 0.
First Choice Computer Decision Analysis.	You made one[1] of the best possible choices for gaining immediate public satisfaction. Caution: You did not make one of the best long-range decisions when considering socievents. Analysis ranks it 6. A cost-benefit analysis suggests that you made an excellent overall decision.
It may also fail.	Your innovation is successfully implemented. You have remaining in your account SD 1 million. Is there another edvent you would like to implement during this two-year planning period?
A mistake; not available until next two-year period.	You may choose[13] each edvent only one and it must be one of the options stated above. Is there another edvent you would like to implement during this two-year planning period?
Third choice	You made a good,[3] but not one of the best choices for gaining immediate public satisfaction. Analysis ranks it 6. Caution: You did not make one of the best long-range decisions when considering socievents.

* SD on the computer will mean $D (Statosdollars).

Computer Decision Analysis.	Analysis ranks it 7. You have made a reasonable cost-benefit choice, but others were better. Analysis ranks it 6. Unfortunately, your innovation is a failure, half of its satisfaction points are lost. Your district is now in debt SD 6.5 million. Is there another edvent you would like to implement during this two-year planning period?
The "1" following your choice will give you a printout of all variables that change as a result. They are in order as listed in the manual.	10 1 Unfortunately, you will likely lose points by the implementation of this edvent. Analysis ranks it 10. Caution: You did not make one of the best long-range decisions when considering socievent. Analysis ranks it 8. You have made a reasonable cost-benefit choice, but others were better. Analysis ranks it 10. Your innovation is successfully implemented. Influence changes: 1 -1 -2 -1 3 3 2 Totals: 79 321 254 108 122 101 21 Socievent changes: -1 -3 2 0 4 2 2 -1 0 2 0 -2 Totals 665 90 221 254 64 93 114 121 123 57 65 19 Your district is now in debt SD 15.2739 million. Is there another edvent you would like to implement during this two-year planning period?
"No"	0
You must put a 1 or 0 under each of them.	Indicate below how you want to edsure to change socievent probability levels: CON PAR TEA STU PRI ACC RED 1 0 1 1 1 0 0 During 1975 and 1976 the following socievents occurred: 1 national GNP growth earns your district SD 2,225,000. 7 teacher strikes cost your district SD 4,500,000. The following socievents would have occurred if you had not implemented edsurance programs: 8 student riots cost your district SD 4,250,000.
"12" under BIO is a mistake; you must put a number between 1 and 10 under each.	Indicate below how you want to edvertise to change influence and satisfaction levels: NEO ESS SOC EXP REC HUM BIO 5 2 2 2 1 0 12 You may not change any perceptions by less than 0 nor more than 10 points. Indicate below how you want to edvertise to change influence, value and satisfaction levels: NEO ESS SOC EXP REC HUM BIO

TABLE IV continued

A single "1" means one under each of them.	1 Edvertising cost you SD 2.002 million during this two-year period. For this you earned an additional 100.0 satisfaction points and increased influence levels by 0 points.
	In comparison to edvertising for earning points, your edvertising is ranked 4.
	You have been charged SD 606,596 interest for overdrawing your account.
	This two-year planning period has now ended. You earned 669 satisfaction points. Total satisfaction points earned since 1975 are 669. Your evaluators have become more conservative. Your public has become more liberal. NOTE: The probability of undesirable socievents occurring has gone up by 30 points. NOTE: The probability of edvent failure has gone up by 18 points. NOTE: The gap now is: +30 +15 +5 +16 -23 -20 -12

TABLE V is a sample of the computer printout for the conclusion to the first ten-year (five two-year) period. It includes a statement of funds remaining in the account, points earned, new values for influence groups and socievent probabilities, edvent failure probabilities, new edsurance costs, and satisfaction points per million investment. To the left are explanations of the computer statements.

TABLE V
SAMPLE TEN-YEAR CONCLUSION COMPUTER PRINTOUT FOR SAFE

+

Explanation	Computer Statement
Cumulates all rounds.	Conclusions to the first ten-year planning period The ten-year planning period has now ended. The status of your account is SD -32.2469 million. Total satisfaction points earned in the game so far are 3,467.

The status of evaluator influence and socievents is as follows:

		NEW	OLD	CHANGE
	NEO	19	80	-61
These abbre-	ESS	313	320	-7
viations	SOC	371	250	121
stand for	EXP	107	110	-3
each of the	REC	130	120	-10
seven influ-	HUM	78	100	-22
ence groups.	BIO	2	20	-18
	GNP	677	666	11
These abbre-	GRE	54	90	-36
viations	COM	207	220	-13
stand for	NAT	257	250	7
each of the	CON	92	65	27
12 soci-	PAR	77	95	-18
events	TEA	161	115	46
	STU	149	125	24
	PRI	130	120	10
	ACC	58	55	3
	RED	95	65	30
	NUC	30	20	10
	ED/F	482	400	82

The new edsurance costs are as follows:

	CON	295500
These change	PAR	134750
because of	TEA	362250
new soci-	STU	326624
event prob-	PRI	227500
ability	ACC	145000
levels.	RED	296875

Total costs now are SD 1.6785 million.

When positive, it means an increase. — This is a change of SD 229125

Total satisfaction points per million SD investment now equals: 33.8267.

Cost

This line gives the cost of useing the computer. — The cost of running this round of the game is 2.81 dollars.

DEVELOPMENT AND EVALUATION SUMMARY

The simulation-game SAFE has gone through a process of development and testing extending over a full year from June 1972 to May 1973. Three approaches for reaching the ten stated objectives for development of the game were tried: two board games, one small group manual simulation exercise, and four completely computerized simulation versions. The results of each approach were tested, but only the computerized versions were found to satisfactorily reach all the original objectives.

The computerized version of the game went through four major stages of evolution and has been tested with six classes from the University of Utah and one from Brigham Young University. Student ages ranged from 18 to 56 with the average around 26 and the most common about 20. Educational backgrounds ranged from Freshman to Post-doctorate. Class sizes varies from 7 to 54 with team sizes from 3 to 20. Average preparation time on the part of students was 7-8 hours with a range from less than 1 to 40 hours. A total of 155 students participated in the game and 105 evaluations (68%) were completed and returned. On the returns, 92% said they enjoyed the experience and 8% said they did not enjoy it. A total of 90% said it was worthwhile for them in view of the time and effort put into it, and 10% said it was not worthwhile when considering the time involved.

In view of the fact that there were numberous "bugs" in the computer program which required frequent terminations of the game, constant changes in the game rules as the model was being developed, manuals which were always obsolete because of new changes, teams which were much too large for lack of additional staff and facilities, insufficient allocated time for participation, and assignments which were vague and cumbersome until almost the last trial runs, we felt that the student response on these developmental runs was extremely favorable.

In general, the most frequently mentioned enjoyable parts of the game in their order of occurrence were as follows:

1) working with the computer
2) immediate responses to decisions
3) seeing future possibilities for education
4) group participation
5) working out interrelationships and making choices

The least enjoyable parts of the game in their order of occurrence were as follows:

1) homework assignments
2) trying to read the manual and understand the game initially
3) having to work in large groups
4) rushing and waiting for the computer

The most frequently mentioned things students learned from participation in the game in order of occurrence were as follows:

1) educational ideas for the future
2) how to bargain and compromise to arrive at a consensus
3) difficulty in a district in choosing and implementing programs
4) the problems of trying to please the most powerful
5) the consideration of long and short-term effects necessary in planning
6) the need to think in terms of many variables when planning
7) how to make good decisions and what to take into consideration
8) the many uses of computers for education
9) the fact that actions and policies of today profoundly affect the future
10) how values and power groups shift

The degree to which the ten original objectives for development of the game were met on the average with the six groups which played it is summarized in Table VI below:

TABLE VI
SUMMARY OF EVALUATIONS RELATING TO THE TEN OBJECTIVES

Degree to which the objectives were met: Not at all 0	1	2	3	4	Very much 5	Objectives *
	2	3	25	49	26	a) Range of educational alternatives learned
1	3	10	34	46	12	b) New techniques for decision-making
	1	11	28	37	27	c) Model for studying schools in society
		5	33	38	28	d) Increased sensitivity to values in society
	3	10	32	41	19	e) Deliberate examination of various issues
2		13	36	34	14	f) Faith in the power of reason to see the future
	1	10	39	36	16	g) Emphasis on long-range public welfare
	4	4	25	46	26	h) Problems judged in terms of situations
1	1	15	31	42	14	i) Future perspective in personal philosophy of education
2	7	19	38	30	9	j) Increased confidence to deal with the world
6	22	100	321	399	191	TOTAL
.5%	2%	10%	31%	38%	18%	PERCENTAGE OF TOTAL

* See page 2 for complete statement of objectives

Table VI shows that 57% of all responses were in the two highest categories, "Very Successful," and 87% were in the highest three, "Successful." Only one-half of one percent of all responses suggested that the game objectives were not met at all through participation in the game.

The five objectives for the game which participants in general most frequently agreed were reached through the game (in order of occurrence) were as follows:

1) Objective a: Range of educational alternatives learned.
2) Objective d: Increased sensitivity to values in society.
3) Objective h: Problems judged in terms of situations.
4) Objective c: Model for studying schools and society.
5) Objective e: Deliberate examination of various issues.

The only objective which received a significantly lower rating than the rest, although over 75% of the participants felt the game was reasonably successful at reaching it, was objective j), "Increased confidence to deal with the world." Many of the participants found the game itself a somewhat future-shocking experience which seriously challenged many of their conventional beliefs and ways of looking at the world and the future.

NEED FOR CONTINUING RESEARCH AND DEVELOPMENT

The newness and complexities of simulations for educational purposes and specifically about the interrelationships between schools and society are such that virtually any well-thought-out evaluative research will make a genuine contribution to our knowledge. Ten specific areas of research and development which might lead from the simulation-game SAFE are as follows:

1) SAFE postulates a model of multiple interrelationships between schools and society. Research is needed to specifically determine these interrelationships so that more sophisticated and accurate models can be designed.

2) SAFE is delimited to modeling the interrelationships between schools and society. The model could be extended to include the entire range of matters which educational leaders must consider in educational decision making such as effects upon the students and the organization.

3) The model in SAFE is based upon a hypothetical district and community power structure. Edvents, costs and effects have been intuitively derived. Research is needed to base the game on a real district and power structure, real educational alternatives and likely effects as derived by groups of specialists using such techniques as the delphi and cross-impact matrix.

4) Only one optimization run has been made to determine what the effects and maximum number of points are under a given set of policies. Multiple such optimization runs need to be made to determine optimum strategies for playing the game and flaws where the model needs to be improved.

5) The simulation-game SAFE needs to be compared with other techniques for reaching the same or similar objectives to establish whether this means of teaching is significantly superior or inferior to others. Also different techniques for playing the game need to be compared to determine the best procedures under various student and environmental conditions.

6) Research is needed to determine which aspects of the game have what effects so that learning outcomes can be more precisely determined and controlled.

7) It has been observed that students with different personalities, values and abilities react quite differently to the game and learn different things. Research is needed to determine exactly how the game affects different kinds of students.

8) The game has been criticized by some for excessive complexity and difficulty in playing and by others for over-simplification. It has been recommended that different games of graduated complexity be developed around the theme of school-society interrelationships and that students have a chance to advance from one form to another.

9) The game has been critized for its particular liberal bias. It has been suggested that there are many ways to look at the interrelationships between schools and society and the kinds of alternatives the future holds. It was recommended that alternative versions of the game be developed which incorporate a variety of theories of man, the schools and the future from the religious, conservative, liberal and communist perspectives.

10) The simulation-game SAFE incorporates a restricted form of computer-participant interaction. It has been suggested that the game could be made more responsive and educational by developing techniques for more extensive interaction. For example, the computer could turn on films, slides and tape recorders, control lighting and actually operate a model bank. The program could be designed so that students could ask a wide variety of questions concerning why various affects occurred and the computer would supply appropriate answers. Visual display devices could graph the effects of every decision and cumulative overall trends and totals. The decision analysis could be extended to include a game strategy analysis with comparisons to optimization runs.

REFERENCES

[1]The persons most responsible for the early development and refinement of the concept of simulation in educational administration and its application to the training of educational administrators were Daniel Griffiths, Richard Wynn, Dan Davies, and Harold NcNally at Teachers College, Columbia. The years 1957 through 60 constituted an exploratory period which tried to determine factors which accurately described the behavior of principles involved in adminstrative behavior.

The first uses of these developmental efforts for instruction occurred in 1959 in the summer workshops chiefly for elementary principals. The next year 232 elementary school principals from various parts of the United States became principals in the simulated Whitman Elementary School within the Jefferson Townships School System. The simulation included 103 in-basket items, planned meetings, dated letters, files, etc. The simulation was later expanded in 1961 and 63 to include problems for persons in roles of high school principal, director of instruction, business manager and superintendent of schools. In 1966 it was revised and updated by the UCEA and renamed Madison Township Schools simulation.

For a detailed history of the early evolution of simulation-games in educational administration, see Dale L. Bolton, editor, The Use of Simulation in Educational Administration (Columbus, Ohio: Charles E. Merrill Publishing Co., 1971).

[2]The number of simulation-games which have emerged in educational administration is very small. Most early simulations were exploratory exercises and not used widely. In addition to the UCEA games (See Footnote 3), only four other games have been used to any extent, John Horvat's "The Collective Negotiations Game" (John J. Horvat, "Simulation of Collective Negotiations," in Bolton, opcit., pp. 198-234), Dale Bolton's "Simulating the Process of Selection of Teachers (in Bolton, opcit., pp. 88-148), and Kenneth McIntyre's "Simulating the Process of Selection of Administrators" and "Shady Acres Elementary School" simulations (in Bolton, opcit., pp. 149-170). None of these games deals with the dynamic interrelationships between schools and society.

[3]Only a few attempts have been made at developing computer usage for professional training by simulation in education. One of the first to be built was the "University Administrators' Decision Laboratory -- 360 Version." It was a computer based management game using a systems model of a university. The model was restrictive, however, and has been used only to demonstrate the potential of computer usage in the field.

At the University of Texas at Austin a CAI approach has been developed for teaching administrative decision-making. It uses computer-based feedback of the in-basket method used in simulations such as the Madison Township game.

Cullinan and Ruderman developed a proto-type computer-based simulation for the UCEA. Their purposed was to investigate the information processing and utilization patterns of administrators through simulation of an administrative decision situation, but school-society interrelationships such as those in SAFE were not considered.

Still other computer simulations have been developed, but none have been used widely and most are proto-type models of automated in-basket manual simulations. One exception to this are the specialized research simulations beginning to emerge such as the McBride simulation of selection policies of 28 junior college dean and presidents. But they are not designed for instructional purposes. See Wailand Bessent, "The Uses of Computers in Simulation," in Bolton, opcit., pp. 198-234.

The need for a computerized game dealing with the complex issues of educational decision-making has been recognized by the UCEA, which just recently received a grant from the Ford Foundation for developing such a game.

Although the educational objectives developed by the UCEA group for their cimulation-game (which has not been developed yet) are very similar, and in many instances identical to those the author has set for SAFE, the games will likely differ considerably in their emphasis. Whereas the UCEA game will emphasize the intricacies of decision-making in the daily running of the schools, SAFE almost totally ignores this aspect of decision-making and focuses almost entirely on the interrelationships between schools and society and the probable long-range social consequences of educational decisions and of social developments on the educational establishment. Whereas the UCEA game will focus on "in-basket" problems, SAFE focuses on alternatives to the schools as they are today. See Walter I. Garms, et.al., "Computer-Based Simulation for Training Educational Decision-Makers," research proposal by the University Council for Educational Administration, February, 1973, p. 1. Non-published.

[4]For a description of this model, see L. W. Downey, "Who Shall Train our Administrators," in D.E. Tope, ed., A Forward Look: The Preparation of School Administrators, 1970 (Eugene: Bureau of Educational Research, University of Regon, 1960), p. 97.

The significance of this model is that it was one of the first to suggest dimensions for analyzing educational functions for both persons within an organization and schools within society. It suggests the need to look for role and goal conflicts among individuals and groups in schools and the need to analyze educational decisions in terms not only of these internal needs, but in terms of the values, ethos, resources, and power groups in the environment. It was a preconditional development for the implementation of systems analysis to determine specific interrelationships and incorporate them into a conceptual whole.

Unfortunately, the educational theorists have failed to advance beyond the state which Getzels and Guba reached 10 to 20 years ago. This early work showed the extreme importance of analyzing the educational setting in terms of both structural and functional dimensions and in terms of both the organization and the society. It suggests dynamic interrelationships both within schools and between and society. But empirical research to actually determine what these relationsips are has been very slowly forthcoming.

[5]At present, the major approach to using systems analysis and the drive behind the building of comprehensive models of school-society interactions is the budgetary program called PPBS (Planning, Programming Budgeting, Systems). Program budgeting, as it is often called, relates the output-oriented programs or activities of an organization to specific resources that are stated in terms of budget allotments, rather than the traditional line-item basis of objectives, i.e., debt service, instructional costs, administrative costs, etc. By this technique of analyzing the budget in terms of overall objectives of the program, it is possible to assess the benefits of specific programs in terms of the costs involved. In view of this "revolutionary" accountability development, Hartley says that PPBS "has resulted in better statements of school accomplishments, more clearly designed program priorities, program budgets, system-wide goals, learning objectives, evaluation criteria, analysis of alternatives, information retrieval systems, and three to five-year projections." See Harry J. Hartley, "Educational Planning-Programming-Budgeting: A Systems Approach (Englewood Cliffs, J.J.: Prentice Hall, 1968).

PPBS is a decision tool which is spreading rapidly in this country. Between 800 and 1000 local schools were in the process of implementing some form of PPBS in 1971-72. But a general lack of technical and financial support from state departments of education have made its use primarily limited to a refocusing of the budget to program objectives and a consequent neglect of explicit program evaluation, generation of viable alternatives, and thorough long-range planning. See Harry J. Hartley, "PPBS: A Status Report with Operational Suggestions," Educational Technology, April, 1972, p. 19.

The critics of PPBS argue that it provides no technique for evaluating the intangible results of education and it allows for no objective automated technique for reaching decisions which must include hundreds of thousands of variables. One of the most interesting new developments which is an outgrowth of PPBS to solve such problems is the EPPBS (Educational-Planning-Programming-Budgeting-System) recently developed and tested by Sisson, Brewin, and Renshaw. EEPS is the product of a three-year ESEA Title III study which began in 1967, completed in 1971, and since tested in six school districts and two county offices. It is a significant improvement over PPBS by using new techniques for planning and decision-making similar to those developed and used in SAFE. See Robert L. Sisson, C. Edwin Brewin, and Benjamin H. Renshaw, "An Introduction to Educational-Planning-Programming-Budgeting System." Educational Technology, February, 1972, pp. 54-60.

[6] The simulation-game STAPOL is perhaps the most important work to influence the general overall development of SAFE as well as both the concepts and content of the edvents and socievents. Numerous weaknesses were found in playing the game and simulation-game SAFE was an attempt to correct some of them. See:

Dennis Little and Richard Feller, Stapol: A Simulation of the Impact of Policy, Values, and Technological and Societal Developments upon the Quality of Life (Middletown, Conn: Institute for the Future, 1970), Document #WP-12.

Dennis L. Little, Richard Rochberg and Richard Feller, Stapol: Simulation-Game Manual (Middletown, Conn: Institute for the Future, 1971), Document #WP-13.

Dennis L. Little, Stapol: Appendix to the Simulation-Game Manual (Middletown, Conn: Institute for the Future, 1970), Document #WP-14.

[7]DELPHI is another simulation-game on the future of society which considerably influenced not only the edvents but also the socievents and the general computer program in SAFE. It was this simulation which showed how the computer could be used to create a game simulating the interrelationships between schools and society. This game also suggested the concept of decision-making which changes the probability of occurrence for social happenings. See Charles E. Osgood and Stuart Umpleby, "A Computer-based System for Exploration and Possible Futures for Mankind 2000," from Mankind 2000, edited by Robert Jungk and Johan Galtung (London: Allen and Unwin, 1969), pp. 346-359.

[8]Osgood and Umpleby based much of their work on the Kaiser Alunimun and Chemical Game called FUTURE (1966). A copy of this game was obtained by the author and played in several classes. The game significantly influenced the development of SAFE through the general developments it postulates and the concept of changing probabilities of occurrence which are modifiable to some extent by the kinds of decisions which are made today.

[9]These futurist techniques were used extensively in the development of the simulation-game SAFE. The edvents are scenarios of possible future developments; their impact on society is the result of future-history analysis and the use of cross-impact matrices, the impact on the evaluators resulted from a modified delphi technique. For a description of these techniques, see Theodore J. Gordon, "The Current Methods of Futures Research," in Alvin Toffler, editor, The Futurists (New York: Random House, 1972), pp. 164-189.

[10] Herman Kahn and Anthony J. Wiener in their work, The Year 2000 (New York: The MacMillan Company, 1967) summarize the basic trends of the western world into a "basic, long-term multifold trend" (p. 7) toward an increasingly sensate, bourgeois, scientific, meritocaratic, urbanized society. The simulation-game SAFE postulates that this trend will continue, but recognizes that short-reversals of the trend will also occur. The nature and concept of a "post-industrial" society was also taken from Kahn and Wiener, p. 186.

An equivalent to this trend has been worked out for education by Michael Marian at the Educational Policy Research Center at Syracuse called "The Basic, Long-term Multifold Trend in Education," Marian suggests that the basis of contemporary and future tremds om education will be around the shift of the system from "closed teaching" to"open learning" where the focus shifts from inputs to outputs, from buildings to the community. The simulation-game SAFE directly postulates the validity of this series of trends into the foreseeable future. Almost every edvent in the game is an extension of its implications.

11 Six of the seven philsophical viewpoints postulated in the simulation-game SAFE were based on two works: Ralph L. Pounds and James R. Bryner, The School in American Society (New York: MacMillan Co., 1967), pp. 486-487, and Theodore Brameld, Cultural Foundations of Education (New York: Harper, 1957), first chapter. Brameld divides public value orientations into four groups: Perennialism, Essentialism, Experimentalism, and Reconstructionism, with the first two being conservative groups and the latter two liberal ones. Pounds and Bryner accept these four groups but add two more which they felt were active value positions not included in the other four: Social Realism and Laissez-Faire. These various philosophies were reconstituted somewhat for the simulation-game SAFE according to modern trends reported in the literature. A seventh group, Biological Reconstructionism, was added in anticipation of emerging value trends which will result from the biological revolution to come.

12 Each of the sixty edvents is based on literature which either describes current innovative programs, recommends new ones, or predicts developments which could be the basis of new programs in the future. Some edvents have been primarily taken from single authors (though many others suggest similar ideas) such as Christopher Jencks and his proposal for voucher programs presented in Edvent 2 (See Education Vouchers, A Report on Financing Elementary Education by Grants to Parents, December, 1970 by the Center for the Study of Public Policy, Cambridge, Mass. OEO Grant #CG 8542). Four edvents were based on ideas in John Henry Martin and Charles H. Harrison's work, Free to Learn: Unlocking and Ungrading American Education (Englewood Cliffs: Prentice-Hall, Inc., 1972). Other examples of significant influence of single authors are Ivan Illich and the Incidental Education Proposal, Paul A. Miller and the Youth Town proposal, Sidney M. Jourard and the Marriage Training School proposal, and Raphael Patai and the Charter Myth School proposal.

Three studies incorporating technological and social forecasts were extremely important in developing a majority of the sixty edvents in SAFE, especially the last 30 which are highly controversial and predicted to occur in the distant future. The first two works, The Year 2000 by Herman Kahn and Anthony J. Wiener (opcit.,) and W. O. Evans and N. S. Kline, Psychotropic Drugs in the Year 2000 (Springfield, Ill., Charles C. Thomas Plblisher, 1971), are the products of American think-tanks which sponsered conventions on the future of society. The last work, Some Potential Societal and Technological Developments 1970-2000 by Paul de Brigard and

Olaf Helmer (Middletown, Conn., Institute for the Future, 1970) is a delphi which incorporated a large number of professionals in recommending its conclusions.

Three delphis which focused specifically on the future of American education were very influential in the development of edvents in SAFE. The first is a non-published delphi performed by Billy Rojas and obtained by the author through Michael Marian at the Educational Policy Research Center at Syracuse University (1971). The second was conducted for the New York State Education Department and performed by Delayne R. Hudspeth in 1970 entitled "A Long-range Planning Tool for Education: Focus Delphi" (Bureau of Two-Year College Programs, June, 1970). The third delphi was conducted by Marvin Anderson at the Institute of Government and Public Affairs at UCLA under sponsership of the Charles F. Kettering Foundations entitled "The Education Innovation Study," American Behavioral Scientist, March, 1967, pp. 8-27.

Other works which significantly influenced the development of the edvents are Dennis Gabor, Innovations: Scientific, Technological and Social (New York: Oxford University Press, 1970). Author Clarke, Prophiles of the Future (New York: Harper and Row, 1958), and Charles M. Darling, Perspectives for the 70's and 80's (An experimental forecast conducted by the National Industrial Conference Board and the Opinion Research Corporation, 1969).

[13] The concept of "revolution" in the game is not to suggest a violent overthrow of civil government, but rather the radical change of influence levels of the educational evaluators over public education in the community. A district educational revolution may result from rapid change in state or national government organization, new legislation, violent acts of students or special interest groups, or the new involvement of previously unconcerned power groups. It is assumed that with "revolution" the entire district administrative staff is fired and replaced.

A GUIDE FOR SIMULATION DESIGN

Charles H. Adair
Professor of Social Studies Education
The Florida State University
Tallahassee, Florida 32306

John T. Foster, Jr.
Instructor of Anthropology
Florida A & M University
Tallahassee, Florida 32307

TABLE OF CONTENTS

FLOW CHARTS

Significant tasks related to the production of a simulation have been incorporated in a series of flow charts. You may wish to consult these diagrams as you proceed through the guide.

THE RELEVANCE OF SIMULATION

So often we hear instructors say that students aren't turned on by their studies. And they are right. Students are increasingly anti-intellectual in their behavior which suggests that they are simply revealing themselves more truly than their parents did. Kids want to do their thing. And is that a bad thing? John Dewey said that "Education is knowledge put to use." When students are forced to read and discuss human events and social problems without enactive involvement, the teacher is depending too much on cognitive motivation. When students gain no experience in making decisions, taking predictable chances and acting on specific value choices they find their studies to be bland and unsatisfying. The claim for relevancy by simulators is one based on the dynamic involvement of students in ways they enjoy toward serious academic objectives.

The mission of this "how to do it" guide is to further change in the social and applied sciences. Hopefully it will accomplish this by refining the talents of potential designers of simulations and yielding finished products. Such objectives are rather lofty since individual simulators are faced with the structuring of knowledge, the application of learning theory and the appraisal of the utility of media. Going beyond these, they are also asked to test their social inventions. Stepping through this work is in effect a trip along the boundaries or research and development.

Applied theory is a concern in that a simulation is a dynamic model of reality. It is characterized by form and function manifested in specified behavior deemed desirable by the simulator. Simulations reproduce more expeditiously, with less possible danger and observable results, what happens in comparable situations in the real world—marital relations, economic bargaining, political persuading, communicating, etc. Whatever its substance the simulation always involves cause and effect processes at work. When these processes are competitive and result in some participant(s) winning or succeeding over others, a game exists. In a game one has conflict but not destruction, because the objective is to outwit the opponent.

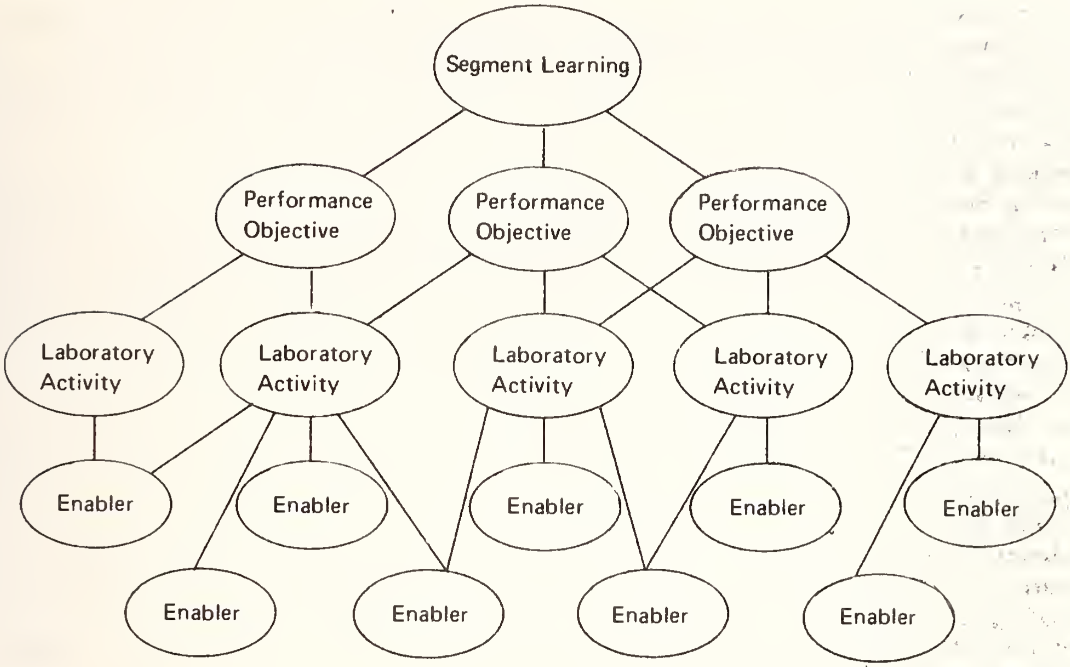
To realize the intent of this guide, students are asked to inform themselves and test their theoretical ideas and predispositions in a continuously adjusted sequence of laboratory experiences. These activities include reading into several books, playing games, and writing position papers leading to the systematic development and the appraisal of simulation prototypes. Of course, such an enterprise demands considerable initiative, industry, and interaction with others.

The repeated experience of the authors using the guide in a university course, reveals the roles of students and instructor to be similar in that a common interest and productivity is expected. Everyone evaluates the performance and products of everyone else, formally and informally. The role of the instructor, it is assumed, is that of a consultant and fellow investigator.

General Objectives for A Guide for Simulation Design

1. To provide experience in designing short simulations.
2. To relate theory to practice in matching conceptual models to content and learning behavior.
3. To become familiar with the literature and products of simulation as a part of the study of social and natural phenomena.
4. To experience in a laboratory oriented environment designed by students and faculty a new teaching learning relationship.

The Reoccurring Structure of This Guide



Segment Learning is the general knowledge and ability to be achieved.

Performance Objectives are those specific products and processes to be completed by students.

Laboratory Activities are those procedures which lead to achieving the performance objectives.

Enablers are those reading materials, films, games and teaching-learning aids to be used in the laboratory activities and personal study.

TO THE PERSON WHO IS WORKING ALONE

Many individuals wish to produce simulations for their own specific needs and have no opportunity to develop skills in a formal situation. This guide is sufficiently structured so as to permit one to consider only the most crucial elements of design as he builds his own simulation, even if the theoretical details are of small interest. Those who are doing this should read the **Introduction** and **Objectives** to each segment and ask themselves "How important is this to me?" When an objective is crucial the related readings, laboratory activities and segment materials would be of high priority. Should an objective be only of slight interest then the readings, lab activities and segment materials may be given short shrift.

A problem arises however in confusing what is crucial with what is easy. And the beginning designer is well advised to take great pains to insure that his design possesses the essential elements of a good simulation. The principle of "garbage in, garbage out" which applies to computer operations is equally applicable here.

GENERAL BIBLIOGRAPHY

1. John R. Raser, *Simulation and Society: An Explanation of Scientific Gaming,* Allyn and Bacon, Boston, 1969, 180 p. (paperback) (Good bibliography).
2. Sarane S. Boocock and E. O. Childs, *Simulation Games and Learning,* SAGE Publications, Beverly Hills, Calif., 1968
3. Clark C. Abt, *Serious Games,* The Viking Press, N. Y., 1970, 176 p.
4. Ronald G. Kietsch, *An Introduction to Learning Games and Instructional Simulations,* Instructional Simulations and Co., 1969.
5. Michael Inbar (editor-in-chief), *Simulation and Games,* An International Journal of Theory, Design and Research, SAGE Publications, 275 South Beverly Drive, Beverly Hills, California, 90212, $10.00/yr.
6. Clarice S. Stoll and Michael Inbar, "Social Simulations," *The American Behavioral Scientist,* special issue, July 1969 published by SAGE Publications, Inc. 275 South Beverly Drive, Beverly Hills, California 90212 (good bibliography).
7. P. J. Tassey and Dereck Unwin, *Simulation in Gaming in Education, Training and Business: A Bibliography,* The Education Centre, New University of Ulster, Coleraine, Northern Ireland, July, 1969.
8. Paul Twelker, "Simulation: An Overview," mimeographed paper, Teaching Research, Monmouth, Oregon, 1968, 48 p.
9. Paul Twelker *Instructional Simulation System,* A Continuing Book Oregon State University, Printing Department, Corvallis, Oregon, 1969, 286 p.
10. Carl M. White, *Sources of Information In the Social Sciences,* Bedminister Press, Vreeland Ave., Totorva, New Jersey, 1964
11. "Instructional Methods and Techniques—An Annotated Bibliography," Training Methodology Part III (ED 024 880).
12. Michael Inbar and C. S. Stoll, *Social Science Simulations,* Free Press, N. Y. 1971
13. Herbert A. Simon, *The Sciences of the Artificial,* The M.I.T. Press, Cambridge, Massachusetts, 1969, 118 p.
14. *Western Behavioral Sciences Institute,* 1150 Silverado, La Jolla, Calif., 92037. This group publishes various bulletins and position papers on game use, research, and design theory, in addition to publishing a variety of simulation materials.
15. *Simulation/Gaming/News,* Box 8899, Stanford University, Stanford, Calif., 94305. A newspaper-size publication dealing with both practical and theoretical considerations. Particularly valuable for those in public school work.
16. *A Guide to Simulation Games for Education and Training,* David W. Zuckerman and Robert E. Horn, Western Publishing Co., New York, 1970. The most complete catalog containing hundreds of game materials in a number of instructional areas; $15.00.

Introduction

To most people simulation is a familiar process. It is the essence of planning ahead and reconstructing the past as well as describing the present. When a class must leave the school building during a fire drill, or a crew must practice its "abandon ship" routine, simulation is taking place. Recently the distinguished newsman, Eric Severied, "interviewed" Lord North about the British policies toward the American colonies (CBS, April 7, 1971, *The American Revolution*). This was done very much in the same manner as previous interviews on television with President Nixon.

In this segment it is important to learn the special meanings of some basic terms to be found in the objectives. As you read they will become apparent. Yet it is important for you to begin to take systematic notes pertaining to the segment objectives and the laboratory exercises. You should enjoy the game and the debriefing, yet keep your guide in mind at all times as you observe what you do.

SEGMENT I

Segment I

INTRODUCTION—Objectives

1. Simulators will be able to distinguish between simulation and other learning activities by accurately applying the concepts of **game, simulation game** and **simulation** in asking and answering questions.
2. Simulators will be able to answer correctly at least ten of the fifteen questions relating to *Simulation and Society* in the quiz at the end of Segment I.
3. Simulators will be able to demonstrate effectively their knowledge of the relationship between abstraction and congruence (detail and accuracy) by explaining to the satisfaction of another student how one is contingent on the other in a 2 x 2 table.
4. Simulators will comprehend and apply the concepts of **learning transfer, simulation fidelity simulator cost** and **utility** to appraise a simple and a complex simulation game.
5. Simulators will be able to justify the use of simulations by employing references to **economy visibility, reproducibility,** and **safety** in discourse.

READINGS:

1. John R. Raser, Chapters I and II
2. Meredith P. Crawford, "Dimensions of Simulations," *American Psychologist,* Vo. XXI, #8, Aug 19, 788-796.
3. Meredith P. Crawford, "Simulations in Training and Education," paper presented at the NATO symposium on "The Simulation of Human Behavior," Paris, France, July 1967, 15 p.
4. E. J. McCormick, "Simulation," *Human Factors Engineering* (2 ed.), McGraw-Hill, New York 1964, 14 pp.
5. Andrew Scott, et al., "The Procedures and Uses of Simulation," *Simulation and Nationa Development,* John Wiley and Sons, New York, 1966, pp. 159-170.
6. Edward C. Stewart, "The Simulation of Cultural Differences," *The Journal of Communication* Vol. XVI, #4, Dec. 1966, pp. 291-304.

LABORATORY ACTIVITIES:

Preparatory tasks:

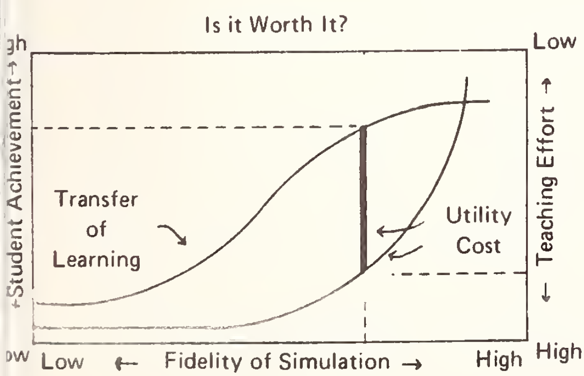
1. Read chapters I and II in Raser. Note the Glossary in this segment.

Laboratory Tasks:

1. Discuss the guide by overviewing the segments.
   a. Note that reading is important to each part, but that individuals have different needs so they may read different material.
   b. It is the general obligation of participants to:
      (1) Achieve the objectives using personal initiative.
      (2) Demonstrate curiosity and, be prepared, when one makes a personal commitment ahead of time.
      (3) Complete laboratory activities.
      (4) Meet performance deadlines as a matter of courtesy to other participants in a class.
2. Play a simple game or simulation: *Seal Hunting, Manchester, Consumer*, and *Ghetto*. The sources of these games are listed in this segment. Note: Should the games *Seal Hunting* and *SIMSOC* not be available, substitutions may be made by selecting a game producing rich experience in a simple format and a game characterized by a complex, theoretically sound structure (in that order) for use in the laboratory activities.
   a. Is it a simulation or a game?
   b. Which type is it in terms of isomorphic characteristics?
   Congruence is the degree of accuracy with which a simulation reproduces a total field.
   Abstraction is the degree of detail, or lack of it, a simulation includes in the reproduction.

		Congruence (Accuracy) High	Congruence (Accuracy) Low
Abstraction (Detail)	High	Type I	Type III
	Low	Type II	Type IV

   c. How would you evaluate this activity in terms of:
      (1) Economy
      (2) Visibility
      (3) Reproducibility
      (4) Safety
3. Discuss the simulation game SIMSOC with the help of the manuals (Instructor's and Participant's). A visual construct for SIMSOC is available in this segment.
4. Compare *Seal Hunting* or the game you have played with *SIMSOC* in terms of the following model.



Criteria	SEAL HUNT	SIMSOC
Learning Transfer	?	?
Simulation Fidelity	?	?
Utility	?	?

5. Be sure to read the flow chart ("An Overview to Simulation Planning and Building") before goir on to Segment II. It provides the conceptual pattern essential to the development of a goc simulation.

   Flow charting is a useful task, and people who are not familiar with it should try several of the own. Flow Chart #2, "How to do a Flow Chart" will be of aid.

6. Upon completion of activities 1-5 and the readings in Raser's book, take the Quiz in this segmen See if you can get 10 of the 15 questions correct. You may use the glossary of terms to help yc during the quiz.

GAMES:

1. *Consumer,* Western Publishing Company, Inc. School and Library Department, 850 Third Avenu New York, New York.
2. *Ghetto,* Western Publishing Company, Inc. School and Library Department, 850 Third Avenu New York, New York.
3. *Manchester,* Abt Associates, Inc. 55 Wheeler Street, Cambridge Massachusetts.
4. *Seal Hunting,* Educational Services, Inc. 15 Mifflin Place, Cambridge, Massachusetts.
5. *SIMSOC,* Free Press. 866 Third Avenue, New York, New York.

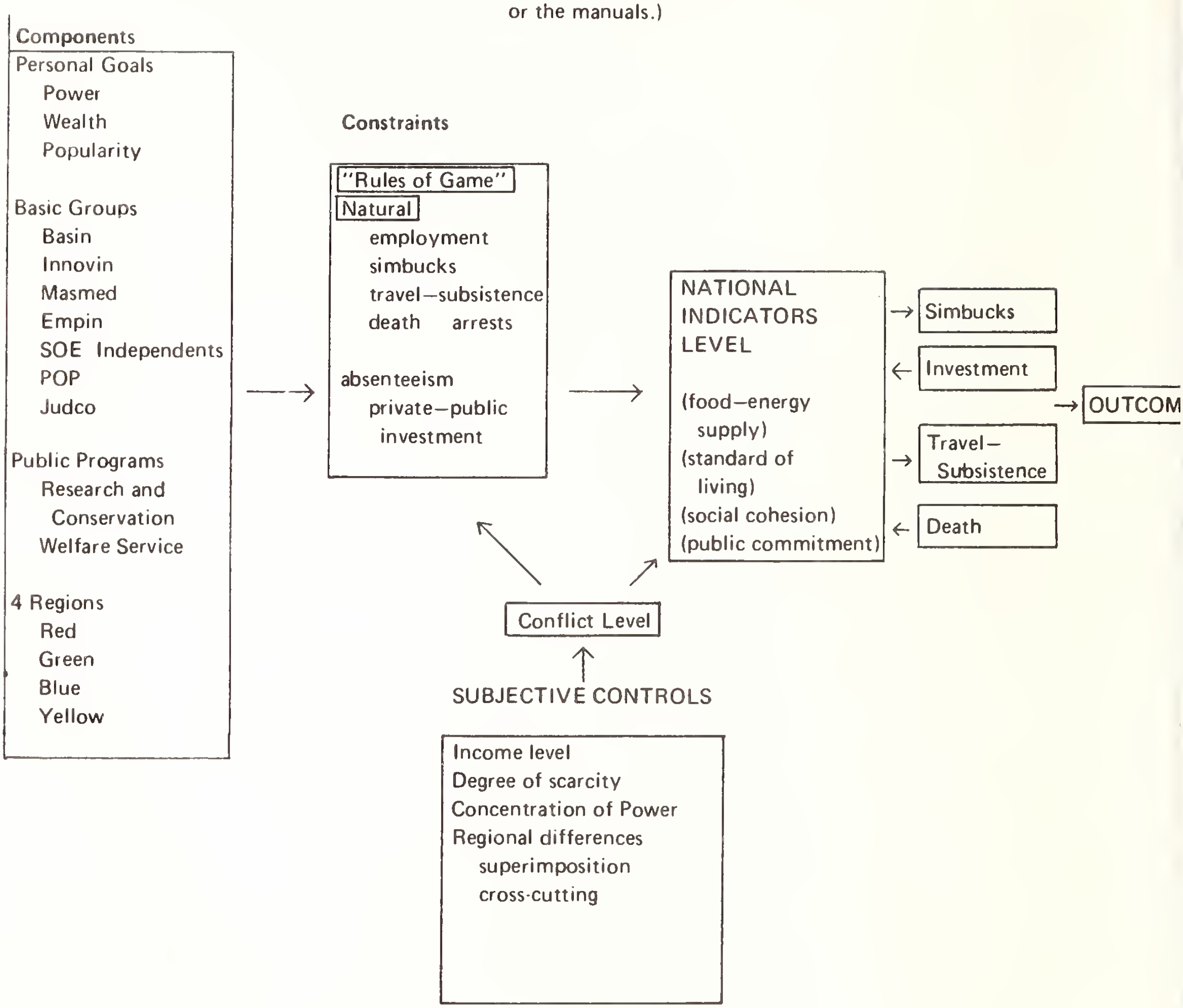
GLOSSARY

Terms Commonly Used in Simulation Design

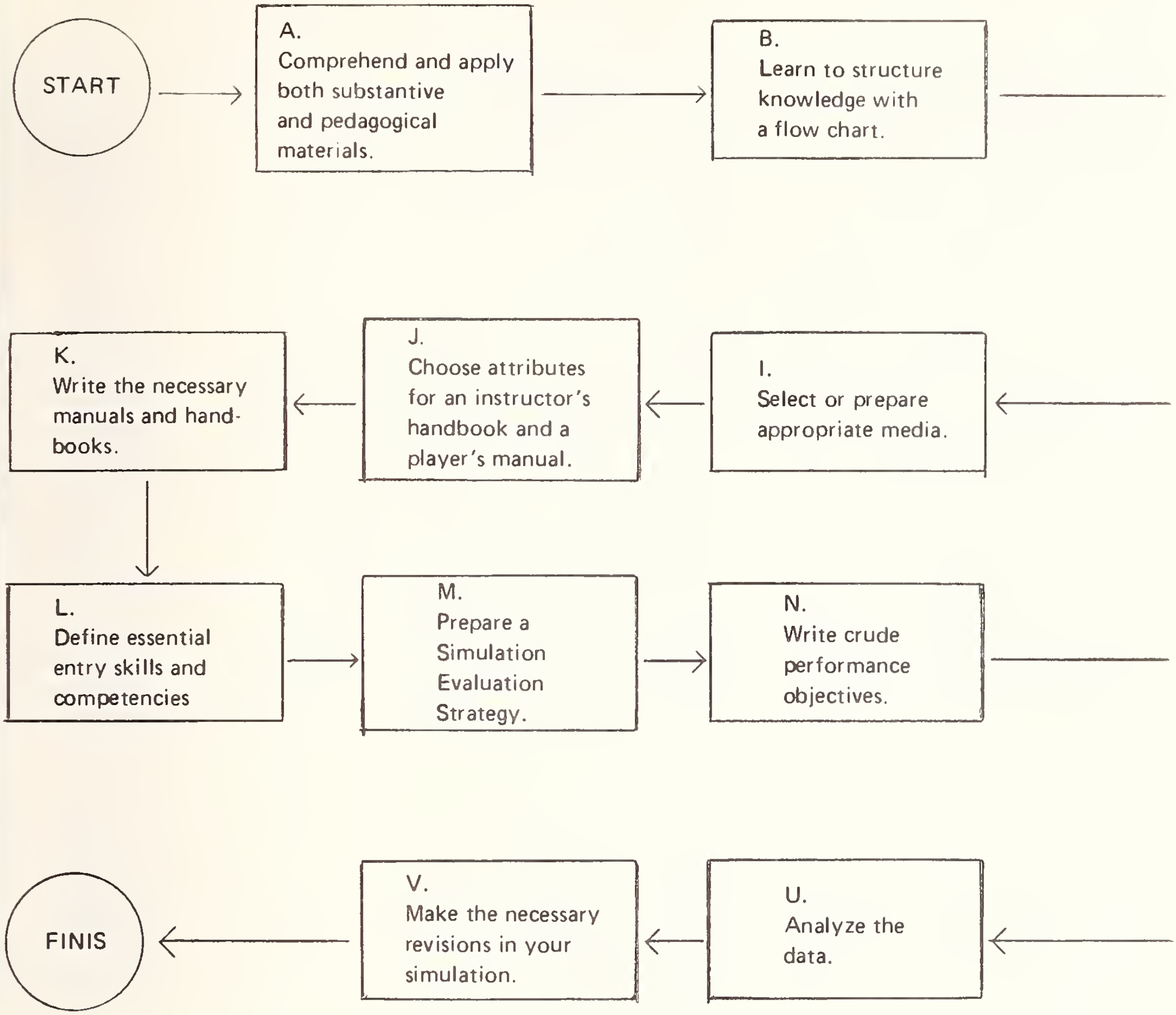
Abstraction	The degree of accurate replication of details of (molecular) functions or attributes of reality in a simulation
Congruence	The degree of accurate replication of major (moler) functions or attributes of reality in a simulation
Economy	The characteristic of saved effort and time that accrues to the user of the simulation
Isomorphism	A combination of congruence and abstraction to meet the objectives of the simulation designer
Learning Transfer	A process of gaining a skill or a concept through a predetermined operation
Piecemeal Simulation	A simulation of an important part of a larger function or condition, the part being crucial in every detail
Reproducibility	The attribute of being accurately replicated over time and in different places
Safety	The absence of the dangers that would accompany a condition or experience in real life
Simulation Fidelity	The degree of accurate replication of real attributes and conditions characteristic of that which is being simulated
Simulator Cost	The total of time, effort, money and materials invested in the development of a simulation by the designer
Skeletal Simulation	A simulation of a total set or system of parts wherein no single part is as crucial as the whole
Visibility	The characteristic of easy to difficult revelation of significant performance of subjects using the simulation
Utility	The difference between learning transfer benefits and cost to the designer

SIMSOC MODEL

(This may clarify some of the information in the discussion or the manuals.)

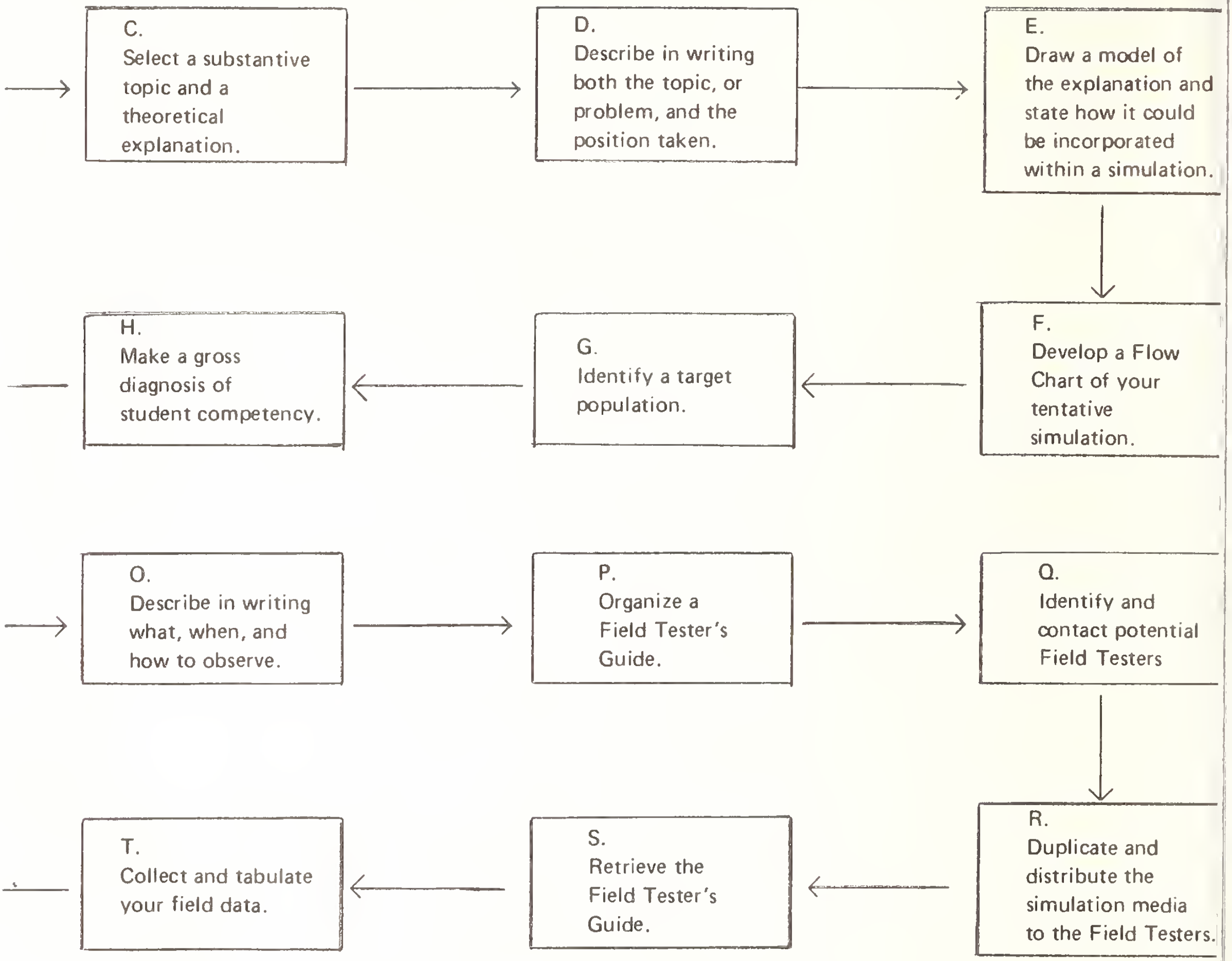


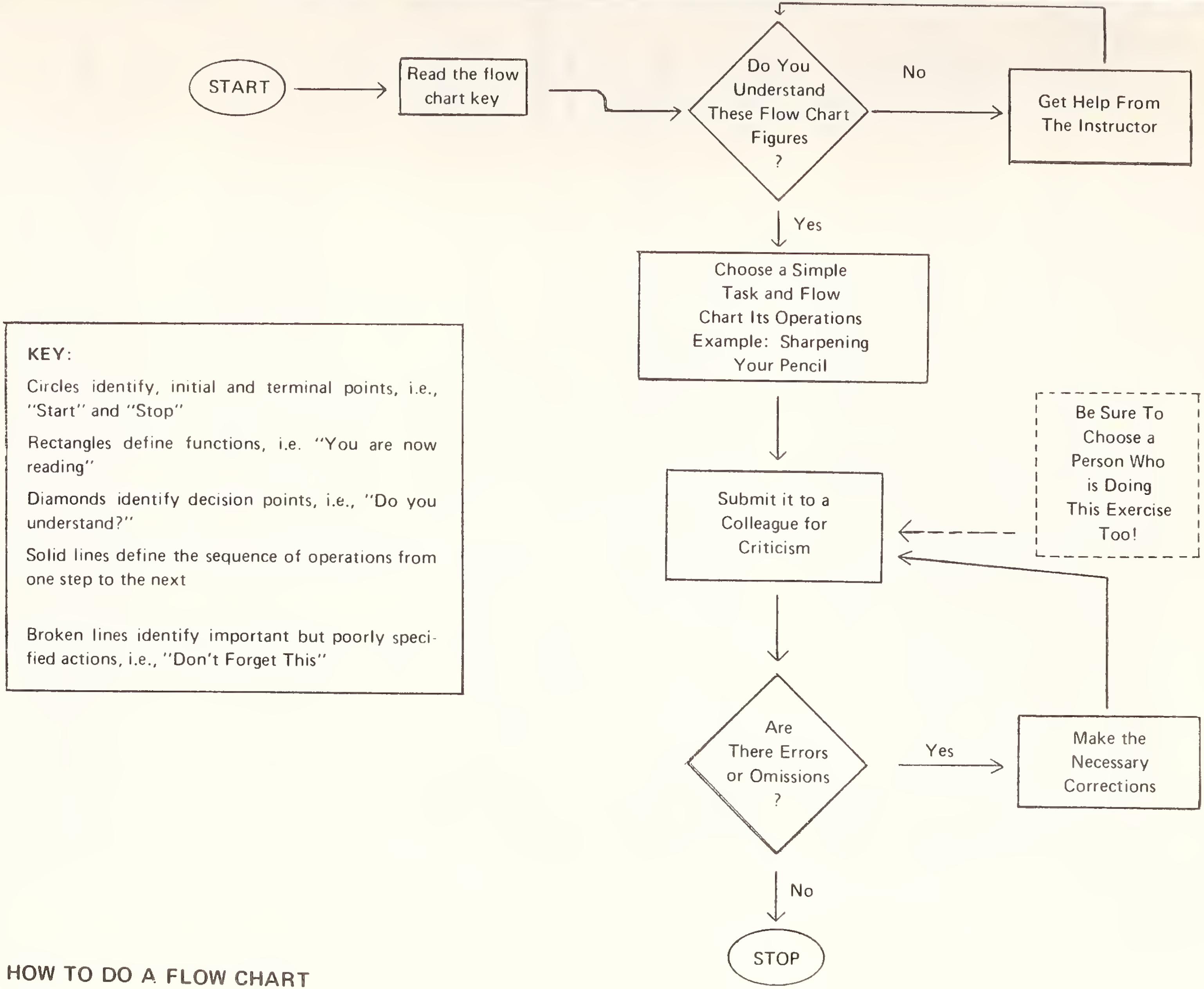
Prepared by Steve Wollard



Flow Chart I

An Overview to Simulation Planning and Building.


C.
Select a substantive topic and a theoretical explanation.
D.
Describe in writing both the topic, or problem, and the position taken.
E.
Draw a model of the explanation and state how it could be incorporated within a simulation.
F.
Develop a Flow Chart of your tentative simulation.
G.
Identify a target population.
H.
Make a gross diagnosis of student competency.
O.
Describe in writing what, when, and how to observe.
P.
Organize a Field Tester's Guide.
Q.
Identify and contact potential Field Testers
R.
Duplicate and distribute the simulation media to the Field Testers.
S.
Retrieve the Field Tester's Guide.
T.
Collect and tabulate your field data.



HOW TO DO A FLOW CHART

SEGMENT I

QUIZ: Select the best response (10 of 15 is a satisfactory score)

1. A simulation is ______

   a. a special form of model emphasizing mostly fixed structural relationships.
   b. a general type of model including most of their different forms.
   c. a general type of model including mostly fixed structural forms.
   d. a special form of model stressing the functional, operating processes.
   e. a special form of model that exactly reproduces a theory.

2. Simulations have an advantage as a research tool in that they can develop the same situation on numerous occasions. This concept is included in which of the ideas? ______

   a. reproducibility
   b. visibility
   c. economy
   d. safety
   e. evaluation

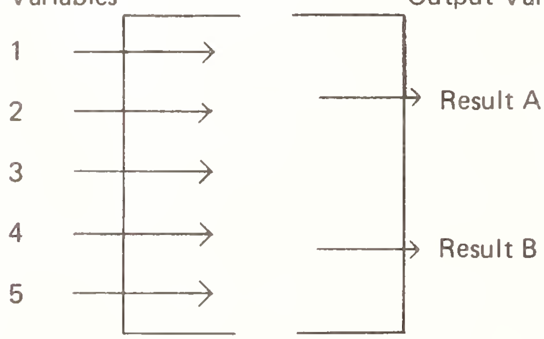
3. Theories and Models ______

   a. are the same phenomena and interchangeable terms.
   b. are different in that the models define the subject matter.
   c. are different in that the theory states a structure but does not display it.
   d. are similar in that both define the subject matter and both display or exhibit its structure.
   e. are different in that a theory may show a static phenomena, but a model may not.

4. A high degree of isomorphism in a simulation implies ______

   a. that it reflects, to a large degree, the situation being duplicated in the number of elements.
   b. that there are many items in the referent system that appear as single units in the simulation.
   c. that the model behind the simulation has an iconic form.
   d. that the model behind the simulation has a mathematical form.
   e. that the model behind the simulation has a verbal form.

5. Input Variables Output Variables ______



   The model above

   a. would be appropriate for many laws in the natural sciences.
   b. would not be a system at all since the relationship between 1 and 2 is not exact.
   c. would be appropriate to show the complexity with which a social scientist is confronted.
   d. would be appropriate to show a low degree of entrophy.
   e. would be appropriate as a referent model.

6. Which of the following is a fitting description for the social science theories? ______

   a. non-systematic
   b. probabilistic
   c. explicit relational
   d. totally entropic
   e. non-self-fulfilling
   f. non-self-denying.

7. A piecemeal simulation ________

   a. stresses a large portion of behavior but not intensively.
   b. has problems in that all things are never equal and laboratory consequences do not reflect real life.
   c. has high validity in that field observations correlate well with them.
   d. are not attempted in limited confines and "sterile conditions."
   e. can't be combined with other small segments usefully.

8. A skeletal simulation ________

   a. has a problem in that some significant variables may be left out for convenience or over-looked.
   b. has a problem in that policy recommendations from it are ignored.
   c. has a problem in that the situation being simulated may be overly simplified.
   d. has a problem in that they are often attempted in the laboratory.
   e. has many problems that are identical with those of a piecemeal simulation.

9. A game and a simulation ________

   a. are distinct and separate "entities."
   b. are different in that the former permit a manipulation of "units and relationships" for competitive purposes.
   c. are different in that the former has more procedures and constraints that are rigorously defined than the latter.
   d. are similar in that they have the same degree of flexibility.
   e. are freely interchangeable terms.

10. A theory may be expressed ________

    a. in a verbal form.
    b. in a mathematical expression.
    c. in a model
    d. in A and C, but not B
    e. in A, B, and C.

11. Abstraction ________

    a. harms the goal of complete replication during a simulation.
    b. is the process in which data is selected for construction of a theory.
    c. is the process in model building in which non-essential details of a theory are neglected.
    d. is the process which helps lead to the goal of complete replication.
    e. is a process that does not raise a question of adequacy or validity.

12. $(A \longleftrightarrow B)$ ________

    The model above

    a. implies a relationship expressed in probabilistic terms.
    b. contains high entropy.
    c. implies a relationship between variables that is typical of some social science laws.
    d. is an ideal never obtained in natural science.
    e. expresses a relationship found in primitive laws.

13. Visibility includes ________

    a. the idea of reproducibility.
    b. the idea that a theory makes meaning more accessible.
    c. the belief that a simulation can make the phenomena more physically viewable.
    d. the belief that a simulation's static model is easily definable.

14. Freud's theory rests on an unsound tenet because ________
   a. he failed to express it in the form of an iconic model.
   b. he failed to consider the zoo laboratory as an item of contamination.
   c. he expressed his theories in a literary form.
   d. he asked an incomplete skeletal simulation.
   e. he used an inductive approach to theory construction.

15. Social science laboratory research and simulation ________
   a. have the same degree of reproducibility and reliability.
   b. are different in that the former has a higher degree of reproducibility and reliability.
   c. are different in that the latter has a higher degree of reproducibility and reliability.
   d. are different in that the former demands a greater degree of involvement.
   e. are similar that they both are more effective than natural science research approaches.

MODELS AND THEORIES

The task of simulating involves a first consideration—what do you wish to simulate? If you can report what it is to another person you have achieved a big step. Most often neophites attempt to grapple with an idea that is too big or one that is not completely understood. Toward the goal of specifying what one wishes to simulate the use of models can make a contribution. Once you know more of models you can report what others have described and/or explained. These three processes are difficult in themselves, and it is hoped that the laboratory activities help you in the matter.

This whole enterprise, as a first step in simulating, is to get at the problem of structuring knowledge. A variety of models, representing conceptual structure are included in segment II. The equally important concern for syntactical structure is illustrated in the flow charting you have witnessed and done. Syntax refers to the order in which things are sequenced and attempts to get at "what causes what to happen?"

When a game or learning activity is based on a conceptual model it is easier to make a claim of validity. At least it is easier for independent critics to judge validity. If the conceptual components are clear and ordered it is easier to conceive the simulation itself. Also there is good reason to believe that the conceptual components will be easier to learn and retained longer by student participants in your simulation after you build it and are putting it to use.

There is an old saying that "you can't teach what you don't know." This is certainly the case in designing a simulation.

SEGMENT II

Segment II

MODELS AND THEORIES—Objectives

1. Simulators will be able to illustrate the (Raser) **concepts** of **abstraction, simplification,** and **substitution** through analogy to **physical, semantic,** and **formal** models.
2. Simulators will be able to identify correctly specific types of models employed in the film, "Model Man" (Econ 12).
3. Simulators will be able to distinguish correctly among examples of **reporting, describing,** and **explaining.**
4. Simulators will recognize the **conceptual** and **syntactical** characteristics of **structured knowledge** in a position paper written by a simulator.
5. Simulators will be able to demonstrate their correct recall of a model by drawing it on the chalkboard and defining its components and component relationships.
6. Simulators will be able to apply the *Coleman Model of Social Simulation* by applying it properly to a hypothetical social situation.
7. Simulators will recognize strengths and weaknesses in using specific interpretive models.

Readings:

1. John R. Raser, Chapters II, IV (Important)

   Sarene S. Boocock, pages 13-104 (Valuable)

   Edmund C. Berkeley, *Computer Assisted Explanation,* paperback, Information International, Cambridge, Mass., 1967, 271 p.
2. Richard J. Chorley and Peter Haggett, *Socio-Economic Models In Geography,* University Paperbacks, Barnes and Noble, 1968, 468 p.
3. James S. Coleman, "Games as Vehicles for Social Theory," Mimeographed paper, Johns Hopkins University, Baltimore, Md., 1968, 20 p.
4. Joseph J. Schwab, "The Concept of Structure of A Discipline," *The Social Studies: Structure, Models, and Strategies,* Martin Feldman and Eli Seifman (eds), reprinted from *Educational Record,* Vol. XLIII, #3, July, 1962, pp. 197-205.
5. Ira S. Lowry, "A Short Course in Model Design," *Journal of American Institute of Planners,* Vol. XXXI, No. 2, March, 1965.

LABORATORY ACTIVITIES

Preparatory tasks:

1. Read Chapter IV in Raser.
2. Study and take notes as you read "Specialized Considerations Pertaining to Theories and Models in the Social Sciences." This is to help you ask questions whenever you need to do so.
   a. Are the types well defined in terms of their properties, and value? Can you think of better illustrations?
   b. Are the sources comprehensible?

Laboratory tasks:

1. Take notes during Model Man (a film produced in Econ 12) and then complete the form:

   Note: The Econ 12 Course and Materials are to be distributed and sold by Addison and Wesley Publishing Co.

Identifying Specific Models and Their Properties

Model Type	Modeling Processes			
	Name	Abstraction	Simplification	Substitution
Physical				
Semantic				
Formal				

2. Read the position paper in the Appendix. Be able to go to a chalkboard and do the following:
   a. Draw a diagram that identifies the factors and relationships between the factors.
   b. Describe the conceptual and the syntactical structures of the paper.
3. Examine the position paper carefully and search for examples of reporting (What?), describing (How?), and explaining (Why?). We will compare them in Lab #2.
4. After examining the Coleman Model in this segment:
   a. What type is it?
   b. Can you apply the model to help explain
      (1) A graduate student's situation in being graded in a typical course.
      (2) The forces at work on the president of a university.
      (3) The position of a student accused of cheating by a teacher as he faces an administrator.
      (4) The dilemma of a new prisoner who attempts to gain favor with his guards and the other prisoners at the same time.
      (5) The problem of a juvenile court judge who wishes to provide complete "due process" of law to an offender, yet protect him from public view.
5. What is to be claimed for the Coleman model in aiding one to report, describe, and explain any of the situations in #4 above?
6. Do you know of a substantive or methodological topic that has a puzzling or difficult dimension that makes it hard to teach in conventional ways? If not, think hard and discover one. Then try to apply what you have learned about simulations and models so far to describe a possible simulation. In the next segment you will be expected to put this into a written form. To accomplish this you should start collecting pertinent references to your topic.

Specialized Considerations Pertaining to Theories and Models in the Social Sciences

Most students of the social and natural sciences are comfortable with several styles of thinking and the use of theory for purposes of description and explanation. Those who specialize in the latter, are most often teachers who must describe and explain with clarity if they are to be successful. As the general nature of theory and model identification is revealed here, the next segment includes rather specialized considerations which curriculum developers should consider.*

Cognitive Sources of Models

Instructors, like most laymen, have found history at its descriptive best to be interesting, at times fascinating. Most often these materials, and those employed to teach social phenomena, are in a literary style. Explanation in this mode is couched in the desires and goals of particular personalities, their political organizations, and their interaction with the cultural environment. For the purpose of theory identification and model building, the literary style provides slight help, as it tends to be bound by specific details of time and place. A description of the start of the Great Depression, by dwelling upon the activities which occurred in a banker's conference on October 28, 1929, cannot be easily reapplied in a different setting and era. You need to know how it started.

More abstract and general than the literary style, with a verbal attempt to be precise, is the academic style. In this form or mode, tentative generalizations or "great" principles are expressed and supported by numerous examples. The particular instances of the doctrine act mainly to clarify it. Prominent examples of the academic style may be located in political philosophy, institutional economics, and intellectual history. Being more precise, glance at Toynbee's *A Study of History* if you have not done so recently. The utility of models drawn from this style is questionable since many of the theories are not operational or testable. It is difficult to base a simulation upon someone's sophisticated hunch.

The eristic style, possessing a strong concern for "proof," more responsibility observes the scientific method, logical comparisons, and information analysis. Most popular with behavioral scientists, this style is evidenced by the work of Pareto, Keynes and Pavlov. David Riesman and John B. Coleman are scholars who have employed it in more recent time. Examples of eristic reporting dominate the social science journals today and provide a great reservoir for those seeking theories with potential as pedagogical models.

Along with the eristic style, the symbolic style is possibly the best place to search for theories for our purpose. With a concern for careful measurement and precise logic, symbolic language is frequently employed. This permits mathematical comparisons and transformations valuable in meeting Bruner's concern for the "wide, powerful applicability" of profound ideas. Many teaching techniques, socio-drama, debating, game playing, and economic problem solving, are derived from this style. Following the idea of adopting with less rigor, the contributions of psychometrics, sociometrics, econometrics, etc., designers will find many theoretical explanations which may be their models for structuring substantive ideas.

Two other styles, postulational and formal, are too elegent for use in social simulation. Indeed they are seldom outside of philosophy, psysics and mathematics.[1]

Kaplan notes:

> . . . these various cognitive styles do not correspond to any classification of sciences according to subject matter. The situation here is rather like that in the arts; the substance of a work of art, what is actually in the work, is indeed shaped by and perhaps even constituted by the style, but not the subject matter, the point of departure for the artist's creation. A romanticist poem or expressionist painting may be more likely to have one subject-matter than another, but that some subject-matter can also be treated in quite other styles. More important, the cognitive styles presented above are by no means listed in order

*The authors are heavily in debt to Abraham Kaplan, to a lesser degree John Madge and Richard S. Rudner, for the substantive considerations in this chapter. Should the reader wish to read in depth the volumes by these three scholars, they are highly recommended and are listed in the bibliography.

as scientific merit, unless this merit is tacitly defined by just such a stylistic requirement. From the standpoint of their contribution to the progress on inquiry these are good and bad specimens of each of the styles . . . What might . . . be said is that the list is in rough chronological order of development in any particular discipline.[2]

Indeed, the problem of maintaining precision of thought and clear communications has vexed instructor and researcher alike in the social and natural sciences. Theories have all too seldom been accepted by instructors as course "content" due to the abstractness of their expression. Yet theories in model form, when brought forward, answer the question "put up or shut up" to all who are concerned with inquiry. Models have the characteristic of "testing" the theory from which they are constructed. If the theory is "ill-defined, vague and uncertain", the matter cannot be easily missed by those who would use it in the laboratory or classroom.

The model and its referent theory, must be complementary in that each possess the same outer limits and factors within those boundaries. To the degree that this is the case, the model is **isomorphic.** This is the essential difficulty in drawing models from the literary and, perhaps less so, the academic cognitive styles. The scope and factors are not clearly delineated. Even in the eristic and symbolic styles, the problem is apparent; the teacher should take the warning suggested in Kaplan's concern for sources:

> . . . certain propositions may command assent, not because of the overwhelming weight of evidence supporting them, but because of the usage of the terms in which they are formulated. When this tendency is overlooked, we risk losing the substance of knowledge by grasping at its shadow. A mixture of tautologies and what have been called "fourinsic slogans" is mistaken for genuine theory, and a program is accepted as its own fulfillment.[3]

Types of Models

Models may be casually considered as being of two general kinds, those which explain the structure of a major idea and those which predict a result with the use of a major idea. The former may be best suited to help students test their own understanding of a situation while the latter helps to do this and more, to predict the outcome of the situation.

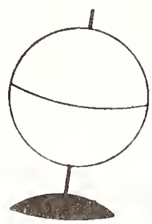
These two categories of models will suffice for many teaching considerations; yet, for those who would be serious parties to curriculum design a more sophisticated definition is in order.

The Physical Model

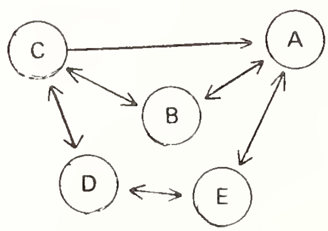
This popular and commonly employed model demands isomorphic similarity only as an analogue; as a physical object it may function quite differently. Buddha as a god and as an idol are quite different in functional reality. A railroad network and the analagous control system have the same scope and structure except they are vastly different in size, material construction and function. The teacher's globe and the earth, the baby and the baby doll, and an almost infinite number of other physical models are easily identified. Models of decision making and game-playing components are not so obvious examples; yet, they are theoretical replications of real situations capable of projecting subjects into the same decision as those in a football game, a business transaction or a legislative compromise.

The Physical Model

The Earth

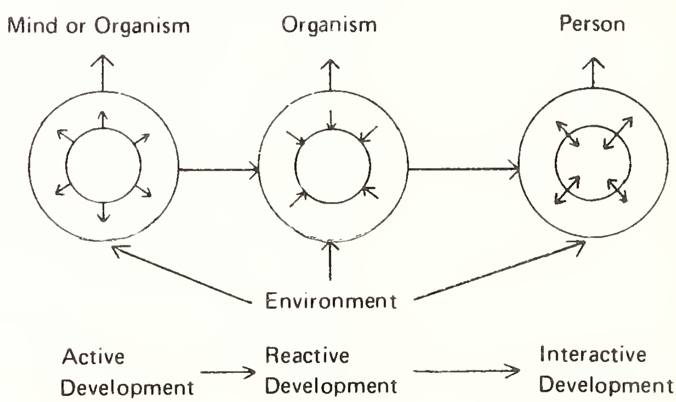


Leadership Roles In A Group



The leader in terms of some criteria responded to by each member of the group (note that each member has 2 choices and that an "A" was selected by more than 2 members.

Three Stages Of Psychological Development[4]



The Semantic Model

As a symbolic or conceptual system possessing a clearly specified structure the semantic model characteristically substitutes the reality of data, established measures of fact and opinion, for easier-to-manipulate symbols. Logical comparisons of various theoretical explanations are facilitated and the fallacies of apparently "good" explanations are highlighted. Also, it is possible to visualize additional rational approaches to the solution of problems by using semantic models, because the structure of a theory that "fits" a situation is exaggerated and simplified, one may bring forth the recollection of similar (isomorphs) factors in a similar arrangement.

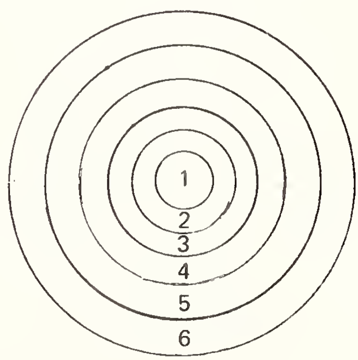
One example, of the use of a semantic model is the reconstruction of a changing economy in the early stage of the Industrial Revolution in England. This was essential to the popular game, *Manchester,* to allow students to learn basic economic principles at work in a historical setting. Integration of knowledge is demanded as the student player develops both "a sense of history" and reliable knowledge of given laws at work.

Perhaps an even more important quality of this type of model is the creation of a relative easy framework within which to view the relationships of various factors or variables. As it focuses attention and demands more precision than physical or literary similarities, one must be involved in what Donald Oliver has referred to as "tough-minded impericism."[5] The analogies presented by a teacher to a class must square with the condition under analysis; vague metaphors will not suffice.

The Semantic Model

Ecological Zones in City Growth[6]

Zone 1: Business District
Zone 2: Wholesale-Light Manufacturing
Zone 3: Workingmen's Houses
Zone 4: Residential Houses
Zone 5: Residential Houses
Zone 6: Suburban-Residential



The Formal Model

In the tradition of deductive thinking so important to economic analysis, a formal model provides a rigorous explanation leading to a logical conclusion of alternatives. The Malthusian theory of population growth to a point of marginal subsistence, is one example. Social scientists wishing to simplify a complete problem and shed light on certain conditioners of human behavior are willing to sacrifice reality in large amounts by making such unreal assumptions, i.e., "all men act rationally in their own behalf". As a result, it is possible to single out the most relevant conditioners and processes of behavior such as in the cases of political decision-making or the investment of surplus profit by economic firms.

When establishing generalizations within a formal model, "all things being equal", satisfies more than a general desire to be precise. It solves the Second Canon of Logic posed by John Stuart Mill.

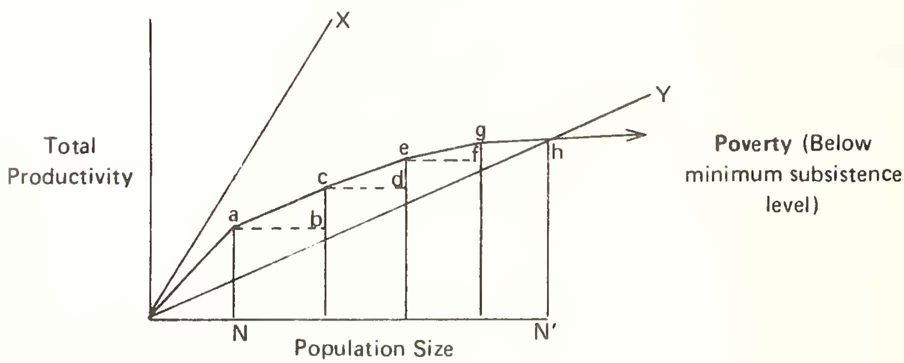
> If an instance in which the phenomenon under investigation occurs and an instant in which it does not occur, have every circumstance in common save one, that one occuring only in the former; the circumstance in which alone the two instances differ is the effect, or the cause, or an indispensable part of the cause, or the phenomenon.[7]

The Formal Model

Population Growth Leads to Poverty [8]

Assumption: Population increases geometrically while the means of subsistence increases arithmetically.

Productivity reaches a point of diminishing returns as arable land is limited.



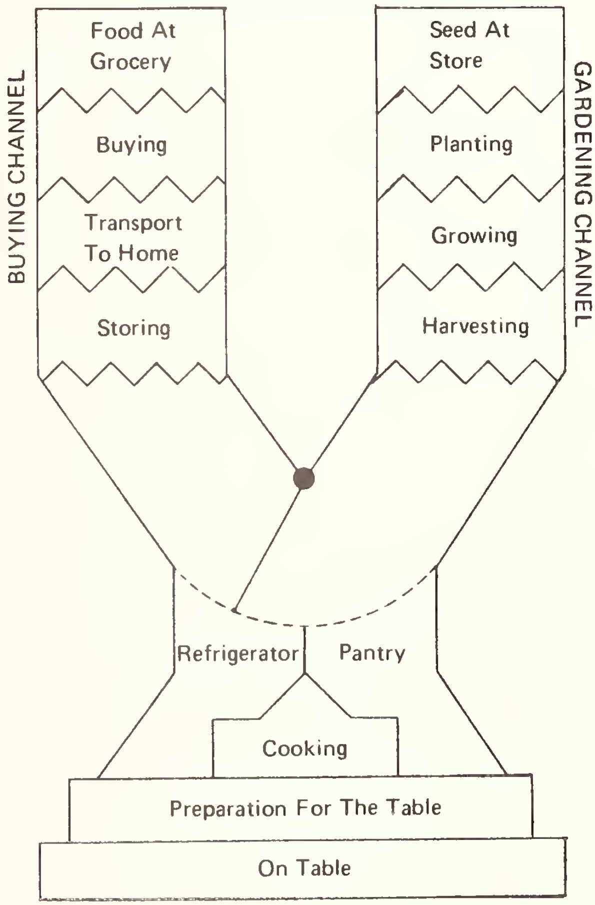
X—Maximum level of subsistence (all a population can consume)
Y—Minimum level of subsistence (the level of poverty and starvation)
N—Initial Size of Population
N'—Size of population at minimum subsistence level
a—Productivity per population N
b-a—Population increase
c-b—Production increase as population increased from a to b
h—A point of total productivity/Total population at minimum subsistence

The Interpretive Model

Frequently, in the process of reasoning about a social problem, one exhausts the rational possibilities of explanation. Quite often the search for explanation gravitates towards a more general explanation that has served in analogous situations involving quite different phenomena. When one can isolate a different independent variable in an old theory and adapt the theory, an interpretive model is the result. Kaplan notes that " . . . its greatest merit is that is allows us to use what we know of one subject-matter structurally similar to the first."[9] A rather dramatic account of such activity is revealed in the constant development of theory in psychotherapy.[10]

An example, is that of the gatekeeper theory developed by Kurt Lewin.[11] The original purpose of the field theory was to appraise the forces determining food procurement habits of American families during World War II. Yet, the main use of the theory, suitably modified, has been to explain the power of political gatekeepers, those individuals who open and close the channels of power and priviledge in government and politics. The original theory helped to determine O.P.A. regulations during the War, and its model, to help appraise political action.

An Interpretive Model
The Gatekeeper Concept



FOOTNOTES

1. For those interested, Kaplan's description will probably be the best source. Abraham Kaplan, *The Conduct of Inquiry*, Chandler Publishing Co., San Francisco, 1964, p. 261.
2. *Ibid.*, p. 262.
3. *Ibid.*, p. 273.
4. Biggs and Hunt, *Psychological Foundations of Education*, Harper and Row, 1962.
5. Donald W. Oliver, "The Selection of Content in the Social Studies," *Harvard Educational Review*, Vol. 28, No. 1, Winter and reprinted in Edwin Fenton, *Teaching in the New Social Studies*, Holt, Rinehart and Winston, New York, 1966, pp. 98-113.
6. Ernest W. Burgess and Robert E. Park, *The City*, The University of Chicago Press, Chicago, Illinois, 1925.
7. John Stuart Mill, *A System of Logic*, p. 256 as quoted in John Madge, *The Topic of the Social Sciences*, Anchor Books, Doubleday and Company, Garden City, New York, 1965, p. 53.
8. Thomas Malthus, *An Essay on the Principles of Population*, Reprinted in John Beatty and Oliver Johnson, *Heritage of Western Civilization*, Prentice Hall, New Jersey, 1958.
9. Kaplan, loc. cit., p. 275.
10. Gordner, Lindsey (ed.), *Handbook of Social Psychology*, Vol 1, Addison-Wesley Publishing Co., Reading, Mass., 1954, pps. 82-95.
11. Kurt Lewin, "Forces Behind Food Habits and Methods of Change," Bulletin of the National Research Council, Vol. 108, 1943, pps. 35-65.

APPLICATIONS TASK GROUP

FACILITATOR'S STATEMENTS

Applications: Research

Richard L. Dukes
Department of Sociology
University of Colorado
at Colorado Springs
Colorado Springs, Colo., USA 80907

Many of the most widely used simulation games have been designed primarily as learning tools through which players come to understand more clearly something about the referent system which the game mirrors. As learning tools, games have many worthwhile advantages including, 1) they can be designed so that they abstract only the most important aspects of the social systems which they model; 2) the simulated social systems which the games generate can be replicated many times; 3) they allow players to actively participate in the simulated social system; 4) they can allow for the expansion or compression of time, and 5) they permit the players to experience potentially dangerous or costly social situations under conditions in which such risks are greatly minimized. These same characteristics of games which are advantageous for learning are also highly desirable attributes of vehicles for social research. However, if social research is to begin to take advantage of the strong points of simulation gaming by tapping the wealth of the hundreds of simulation games currently available, then procedures must be developed for converting existing games into products which allow the gathering of data for testing social theories while still preserving the playability of the games. The use of games in social research does not necessarily preclude their use as learning tools, as revised games probably can serve both learning and social research purposes adequately.

In order to successfully use simulation games as vehicles for social research, the social scientist must answer (at least implicitly) questions for which working guidelines are needed. These questions include, 1) how does one decide whether a game is worth the work necessary to convert it from a learning tool into a vehicle for social research, and how can the social scientist choose between two games which seem to mirror the same phenomena? 2) how can the optimum tradeoff be gained between preserving the original rules of a game (to allow comparability between studies involving the same game) versus the modification of the game rules (to better fit theoretical and methodological considerations of a current study? 3) since research procedures have the potential to destroy playability, how can the optimum tradeoff be gained between play-ability and adequate research procedures? 4) is reliability a necessary condition for the games themselves as well as for instruments for measuring play of the games? 5) how does one decide is a simulation game is valid enough to be used in social research?

MEDICINE AND SOCIAL WELFARE
FACILITATOR'S STATEMENT
JOHN T. FOSTER, Jr.

Department of Sociology, Anthropology and
Human Services
Florida A. and M. University
Tallahassee, Florida 32307

A description of the "state of the art" in medicine and social welfare should always be a crude guess. This belief is warranted when many professionals are finding novel ways to employ published simulations while others are working on designs for new ones. Shouldn't this be encouraged?!

Either situation, innovative utilization or writing, requires creativity. The following categories are offered as starting points which could lead to different perspectives and thoughts-- inputs for acts of originality.

STARTING POINT 1. The oversimple example. (Distort reality and drive others to search for a more real state of affairs.)

a. This notion combined with a published simulation.

In teaching some aspect of medicine or social welfare, select a simulation based upon some poor explanation of the phenomena. Play the simulation as intended by its author, and afterwards have the group of learners chop it up in discussion.

b. In a new simulation.

STARTING POINT 2. The reversed subject. (Talk about heaven by first showing hell.)

a. This notion combined with a published game.

Instruction about "progressive" social welfare centers might be started with a simulation which portrays the worst state employment agency. Face the learner with an outrageous but valid example.

b. In a new simulation.

STARTING POINT 3. The unexpected participant.

a. With a published game.

Interesting things can result in using people in a simulation for whom the activity was not intended. Patients in an outer office might kill time with a very simplified game originally intended for the staff.

b. In a new simulation.

STARTING POINT 4. The crafty administrator. (A good watcher may learn)

a. With a published game.

Select a controversial, stress producing simulation and have potential employees interact within it. (Ignore the game's cognitive goals.) Observe how these individuals respond both facially and vocally. Valuable clues to attitudes and values can be exposed.

b. In a new simulation.

STARTING POINT 5. The sudden stop. (Interesting comments can be generated when a tire blows out.)

a. With a published game.

Play a simulation long enough to expose a set of circumstances. End it in the middle where several alternative conclusions could be projected. Permit the learners to argue over rational answers to the quandary.

b. In a new situation.

Questions.

1. Can you think of specific examples which would fit into each category?

2. Are there other categories to be added to this list?

David E. LaHart
Environmental Studies Group
Florida State University
Tallahassee, Florida 32306

The urban environment is a complex, ever changing system of interacting forces. Economic, political, social and environmental constraint provide a core of interrelated, interconnected and interdependent systems. At the center of these systems are human decision-makers, acting individually and in formal and not so formal groupings.

By examining the urban environment in simple planning components, it can be understood despite this complexity. Rules and ethics well defined by culture, underlie these systems. As systems tend toward balance, generalizations and patterns become discernable. These provide frameworks for simulations.

Working models of urban systems for education and planning purposes can be made to conform with real world patterns. The problem comes in designing models and simulations that provide insights into functioning of the urban system. And understanding the functioning of urban systems is needed for sound urban planning education.

Several urban planning simulations are currently on the market. The earliest of these are the METRO and METROPOLIS series designed to simulate a medium sized urban area. These simulations emphasize the short range decision-making in a framework of a capital improvements program, tax structure and elections. Participants role play politicians, administrators, educators and businessmen as part of the simulation. The Cornell Land Use Game (CLUG) investigates land development, speculation and land use control by permitting large areas of land to be developed while using available resources.

These early simulations spawned a whole generation of new ones. The computer-assisted REGION and CITY games are based on a hypothetical urban area with a population of 300,000 and attempts to simulate the economic and political forces at work. Todays educator finds an elaborate collection of urban planning simulations ranging from NEW TOWN to Hubbard's elaborate URBAN SYSTEMS.

Today we must address ourselves to these questions:

1. To what extent is function simulated in existing games?

2. What are the major functions of urban systems?

3. How can these functions best be simulated?

4. Are piece meal or skeltal simulations most useful in testing urban functions?

5. Values of simulation in discovering future problems before they occur?

TEACHING-TRAINING: ELEMENTARY-SECONDARY EDUCATION

Facilitator: Harriet Elizabeth Arnold
Master's candidate in Social Studies Education
Florida State University
Tallahassee, Florida 32306

If we assume that the principle function of a teacher is to teach some subject matter, attitude, or appreciation to someone or to some group; then we should be spending more time studying the best methods for teaching any particular subject matter, attitude, or appreciation. If the method is effective it will change the behavior of the student or the beliefs held by the student. The use of simulation games is one of these possible methods. However, to justify the time and effort spent in making a simulation game and the money spent by the school on them, they must do the job of teaching certain material, attitudes, or appreciations better than any other feasible method.

The position of the facilitator is that any interaction between people, or between the environment and people can be simulated with enough congruence that it could be useful in the classroom. When teaching the interactions of persons with each other or persons with their environment the least effective method is talking about that interaction. Using films and demonstrations the students can see the interaction, but the best method is participation in the interaction by the students themselves. They don't watch it. They do it. It is not possible for the students to make actual city planning decisions, or to interact with another culture. They cannot go back in time and fight a revolution. They can do these things in a simulation game. In the Promise of Land the students migrate westward. They make the decisions on where to go and the best route for getting there. In Seal Hunt the students hunt for seal with other eskimos.

The simulation game is not just to put the students through a useful experience. It must be based on a viable theory and should teach some useful concepts. The game should be structured so that the student must put these concepts into practice during the play of the game. We expect change to take place in the behavior of the student as he plays. The teacher will be able to observe easily this change without interfering with it. In Seal Hunt the students must learn the concept of cooperation and apply it in their play or die of starvation. In the Promise of land the students must judge the plausibility of rumors and stories from other settlers. If they judge incorrectly they might settle in an area which yields only a subsistence level of crops.

An actual experience of a phenomenon is the best teacher, but the simulation game can put the student through the same or close to the same circumstances in the safety of the classroom and with little cost to the school. The teacher must choose carefully among the many games available since some are developed like commercial games with no proof of validity.

COMMUNITY AND PUBLIC POLICY APPLICATIONS OF GAMING-SIMULATION

Facilitator's Statement:

J. Robert Hanson, Manager
Educational Systems Division
Scientific Management Associates
Gloucester, New Jersey, U.S.A. 08030

Our subgroup, under the rubric of "Applications", is asked to consider some of the uses to be made of games and simulations for community and public policy determinations.

As members of spaceship Earth, we desperately need opportunity to learn new roles -- as parents, as citizens (world/country/state/county/municipal) as educators, as human beings, as futurists -- perhaps as historians, and certainly as spokesmen for the "gentler virtues". Public policy (a "white propaganda" term) is often neither of nor for the public, but it is certainly policy. Perhaps games and simulations are among the vehicles an awakened citizenry should choose to become involved in policy research and decision-making. The process of involvement may contribute to a better future while it simultaneously teaches us better applications for old roles needing resuscitation.

Issues for discussion might include:

- the utilization, through gaming, of non-elitist decision-making structures in traditionally hierarchically directed institutions -- public and private (e.g., a school system or a church), and the resultant conflict over authority sources

- the impact of community participation in identifying needs and setting goals, e.g., municipal government, state educational goal setting, relative to futures-planning, etc.

- the impact of gaming/simulation as a by-product in teaching certain types of research techniques and systems approaches to planning, e.g., the conduct of a needs analysis, etc.

- conveying values (e.g., participatory democracy, town meeting revisited, educational activities/goals in light of costs -- referendums, etc.) otherwise lost, overlooked or rejected by our impersonalized and under-informed society

- the impact of simulations as a way of testing acceptable futures and as a way to accelerate public policy decisions in critical areas, e.g., humanizing the learning process, conserving resources, developing an economic basis for peace, etc.

- the identification of critical social issues as a result of broad community participation in a planning/needs assessment procedure.

COMMUNITY AND PUBLIC POLICY APPLICATIONS

FACILITATOR'S STATEMENT

GEORGE M. McFARLAND
Co-Editor of Simulation Sharing Service Newsletter
221 Willey Street
Morgantown, West Virginia 26505

It would seem to be a given fact that this task group should pool its collective knowledge to at least list and annotate the simulations that are now being used to either assist in the process of formulating public policy or interpret that policy. My experience has shown that simulations are being used in both areas.

My experience has been exclusively in the area of using simulations to assist people in their understanding of the nature of their community as well as the processes that are used for formulating public policy. I am aware that simulations are also being used to aid decision makers in their task of formulating their community and/or public policy decisions.

There is indeed an overlap between these two defined areas that I believe is most important to keep in mind. It has been demonstrated that as people become aware of how decisions are made and learn who the decision makers are, they can become part of the process. This indicates that one might introduce and administer a simulation to inform participants about a particular problem in the community and later discover that the simulation has become part of a subsequent decision making process. By the way of illustration, let me use Metro-Apex. It could be used to inform citizens of the complexity and problems of maintaining good air quality in an urban area only to become the source of a speculative and corrupt real estate operation.

In summary, I would see the task of this group being to identify simulations presently being used to explain or assist in formulation of public policy. After identification, a brief statement of their nature and then a tentative listing of possible outcomes of their useage. It would also be helpful to identify groups or individuals who have been successful in their application of simulations to this area.

ISSUES IN GAME USE: WHAT VALUES ARE CONVEYED BY GAME DESIGNERS AND USERS?

PANEL MEMBERS STATEMENT

GEORGE M. McFARLAND
Co-Editor of Simulation Sharing Service Newsletter
221 Willey Street
Morgantown, West Virginia 26505

To generalize about the values conveyed by game designers and users through the media of simulations one must first admit to all sorts of exceptions to the general statements. Regardless of the exceptions and special concerns, there do seem to be several statements that can be made about values promoted by simulation games.

Being a theologican by vocation I shall make my observations through a statement of faith that seems to emerge in some degree in all simulations.

Simulation Game Designers' Creed

If one can discover a system that explains or predicts certain events or decisions there is a framework for a simulation game. When the game is complete a participant may experience the simulation and thereby gain valuable experience for dealing with the subject in the future. Why? Because they will have a system for analysis and/or action.

People enjoy competition both in simulations and real life. Games make no sense unless or until one can discover the "pay off" and how to maximize the rewards. People want to know who or what won.

Time is a critical factor. People who waste time or have trouble utilizing time will become losers and/or victims. Those who are sensitive to time and use it wisely have an advantage.

The imagination is an invaluable analytical tool. Much can be learned if a person's imagination is stimulated and alternatives are explored. Simulation games reward imagination and encourage participants to experiment with different strategies.

The advantage goes to those who examine the past in order to consider the present and plan for the future. Simulation participants learn that great satisfaction can be gained by future planning and anticipating future alternatives.

Simulations encourage people to pay attention. Those who listen to and/or read instructions carefully are to be rewarded. Simulations definitely develop the participant's awareness of the importance of keeping an open mind, at least long enough to understand the situation.

These then are the values that I see simulations consistently transmitting to participants.

SIMULATIONS AND GAMES AS GROWTH GROUP EXPERIENCES

Judith Foster Karshmer
University of Massachusetts
School of Health Sciences
Division of Nursing
Boston, Massachusetts 02116

Recent sociological literature addresses itself to the use of simulations and games as educational teaching tools (Boocock and Schild 1968, Greenblatt, 1971) and as vehicles for systems based research. (Guetzkow 1966). Very little has been written regarding the use of simulations and games as a potential means for providing personal growth experiences for participants. The little that has been published (Jones and Pfeiffer 1970), (Krupar 1973) more easily falls into the "Role Playing" category and is limited, in that, the emphasis is on individual roles rather than on interacting systems, the essence of the simulation model. At the University of Massachusetts Division of Nursing an attempt is being made to utilize, in its true sense, the simulation game model for personal growth group experiences.

Historically types of collective experiences likely to be used as personal growth groups included, T-Groups, Sensitivity Training, value clarification groups, consciousness raising groups and educational self groups.

It is the hypothesis of this paper that simulations and games may well provide an even more fruitful growth experience due to the inherent dynamic interaction that occurs within a simulation.

The unique usefulness of games and simulations as growth group experiences does not lie in the increased cognitive learning a student may gain from participation or in a grasp of referrents for concept learning. This may indeed occur but is secondary to the purposes and priorities of this utilization.

Then what is a simulation game to offer participants? If the game is to maximize an individual's developing an awareness of himself and facilitate his sense of existential being, how is this to be done?

The experience uses as the most powerful portion of the simulation game the debriefing following the playing of the game itself. After having played the game a large portion of the time is devoted to discussion and a group session.

What kinds of things will be discussed if not the content and principles of the game?

1. Who were you in the game? How did that feel? What facilitated such a feeling? What hampered such a feeling? How come you did what you did?

2. Who were the other people in the game? How did you view them? What thought did you have of them? How did you feel towards them? What was that feeling based on?

3. How does your perception of another participant affect that other individual?

4. In the game, was there a difference in your thoughts and feelings of yourself and others? How?

5. What did you do differently in the game than you might do on the "outside?" How come? How did it feel? What made it easy/hard? What changes would you make with the design to allow you to act differently?

6. Who did you feel close to? Who did you feel far from? How come?

7. What did you learn about yourself? How does it feel?

8. What does this experience have to do with anything?

REASONS THAT A SIMULATION GAME IS SO WELL SUITED TO SUCH A PURPOSE.

1. Simulation Games vs. Role Playing

As mentioned before such a use of games and simulations is beyond that of only role-playing. Role-playing requires an individual to take on a short, "one shot" situation with one other person. There is no chance to try several ways in a particular situation, or to see others reactions to various modes.

It is often difficult to become involved in role-playing as one may not be able to make the connection between the oneself. In a game a structure provides a system in which one must interact. Although a role may have been assigned, the manner in which one continually relates to the structure, provides data to make connections and clearly see personal styles within the role.

II. Safety

A sense of "safety" exists within a simulation game due to the inherent constraints placed upon participants. Such "safety" is often lacking in other less structured group experiences. Participants always have the option to see involvement as representative of personal styles or to interpret it as a result of the simulation.

"Safety" is also apparent from the point of view that a competent, experienced, growth group leader is available to facilitate personal growth and circumvent destructive interactions. She is also concerned with using the anxiety generated in a constructive way and providing a "closure" to the end of each session. In fact, such a case of games and simulations ought not be attempted by the novice.

III. Life Planning

Simulations and games provide the opportunity for students to function within a system not yet familiar to them. This not only allows the student to "fantasize" as to how things might be in the future, but also see the consequences of certain behavior or values. (Example - marriage, childbirth, family/professional commitments.)

IV. Dynamic Feedback

The student participating in a growth group simulations and games is offered the opportunity to experience the dynamic force of their own behavior. Immediate feedback is provided. She may try out new behavior at will.

V. Fun

Often growth group experiences are seen as painful and anxiety producing. Simulations and games lend credence to the philosophy that learning can indeed be fun and that looking at one's own behavior is an enjoyable experience

VI. Relationships with Authority Figures

Participation in simulations and games will encourage the student to investigate her own attitudes in regard to authority, and authority figures. The consequences of such values will be discussed and evaluated. It is hoped that a student will become more realistic and aware of her relationships with not only authority figures (i.e. teacher, parent) but also authority in sense of rules/obligations.

VII. Group Dynamics (System Integration)

By virture of its definition, simulations and games set forth an operating model, a dynamic system. This provides participants not only a chance for individual growth and development, but a wealth of potential for learning about the basics and essentials of group functioning. Not only how the group "works", but the consequences of such arrangements can be studied and reviewed. Group effectiveness can be considered - a possibility most difficult to identify in more traditional growth groups.

As can be seen, the emphasis for simulations and games as a growth group is on the individual learning about herself. The game itself, its content, the situation it simulates is secondary to the goal of providing students with a vehicle for personal growth.

Simulations and games will add a much needed alternative to more traditional growth models. This proposed application is the first step in unleashing the personal growth potential that exists in such a tool. As more work is done and data accumulated the stronger will be the contention: Simulations and games may prove a viable part of the techniques used in not only teaching, but counseling and psychotherapy.

DEFINITIONS

Simulation: "An operating model of central features or elements of a real or proposed system, process, or environment." (C. Greenblatt, "Simulations, Games and the Sociologist," The American Sociologist, 1971).

Game: "Any contest among adversaries operating under constraints for an objective (a victory, win, or pay-off)" (Abt, "Games for Learning", Simulations Games for Learning, 1968).

Growth Groups: "Experimentially based situations concerned with reactions, responses, thoughts and feelings in experiencing the self and others. The purpose being to provide the learner with more understanding of herself and how to use herself in a deliberative way."

THE DISORGANIZED HEALTH CLINIC AS A SIMULATION

John T. Foster, Jr.
Florida A. And M. University
Tallahassee, Florida 32307

Introduction:

This paper is a brief journey from the presentation of a problem and a model which explains it to a glimpse at a teaching simulation. Through such a venture the applicability of simulation in the health area will be further demonstrated. Should it provoke thoughts upon other topics for new simulations in teaching, the author will feel it served a useful purpose.

The Problem:

Individuals who have lived in or upon the fringes of medicine can always cite accounts of patient ineptness and of patient bugling. Perhaps none can be more devastating than when he has prescribed something for himself as treatment. The spectrum runs from a migrant laborer's wife who consumed "lead" pellets to induce an abortion to the young mother who frequently inserted a tampax thinking it has some value as a contraceptive. On a less startling scale, women--particularly among the poor and badly educated--desire having families with several children, and end up with considerably more offspring. (Children for whom little familiar resources often exist.)

The failure to abstain knowledge and methods of preventing conception is found even in a setting where a state offers free counseling, information, pills and I.U.D.'s to a target population of 266,632 childbearing age women. (H.R.S. 1973) The system of distributing family planning materials through county health clinics (at least one in 67 different political units) covers the entire peninsula. While this is the situation, of the 68,043 women who took advantage of the aid about 45% will stop returning. (H.R.S. 1973)

Data supports the notion that many women wish to limit family size (Chilman 1968), appear at clinics for service in the family planning area, attend several times and then stop coming back. (H.R.S. 1973) Why does this happen?

Numerous explanations can be offered. Too few clinics, inadequate funding for those in operation, personality and social problems of the clients are all possibilities. A portion of an answer lies in the structure, organization if you prefer, of the delivery centers. To elaborate upon this point requires examining a position taken by Robert Merton in the field of social disorganization.

> "Social disorganization refers to the inadequacies in a social system of interrelated statuses and roles such that the collective purposes and individual objectives of its members are less fully

realized than they could be in an alternative workable system." (Merton 1961:720) "The sources of these deficiencies include such topics as inadequate socialization of the members of the structure--implying a lack of necessary values, data, skills and the organization's failure to adapt to the social enviroment. Compounding these problems is likely to be a breakdown in communications such that individuals do not understand the messages sent within the system or fail to receive the correct ones. As this happens, the situation is further complicated by divergent values and concerns among various groups within the structure. The structure below is more disorganized than the one on the lower portion of this page." (See Figure I)

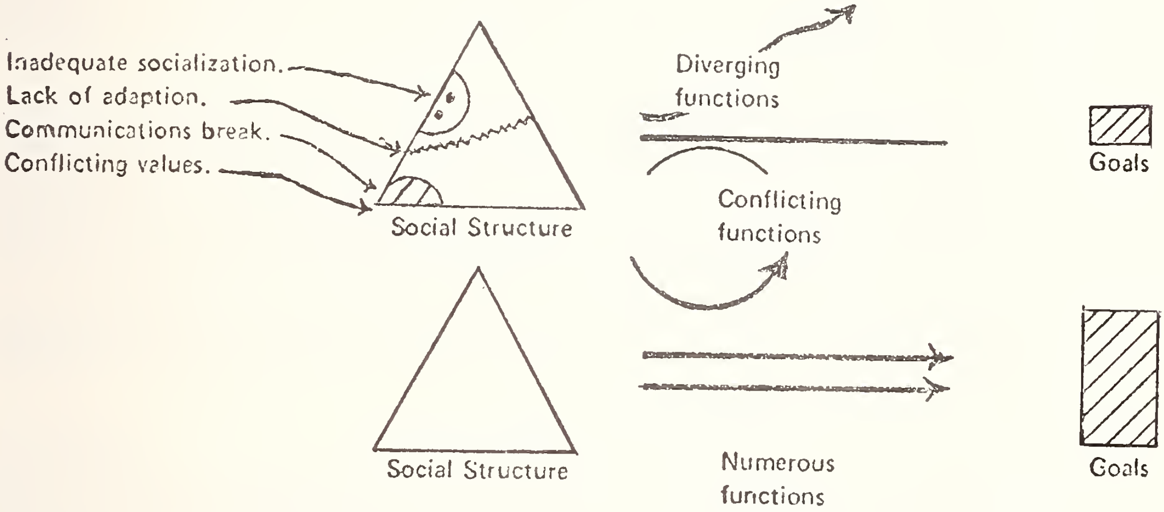


Figure I

(Adair 1972:4)

These models are of help in explaining the current state of many health clinics which provide free family planning information and contraceptives. The following generalizations can be supported by statements that lend themselves to an interpretation very congenial to Merton's.

1.) Nurses and Doctors do not often undergo adequate socialization. Data, Statements, etc.,

a. "One serious problem seems to loom above all others. . . it is the lack of prepared nurses, knowledgeable in methods of contraception and experienced in teaching and counseling patients on human reproduction and birth control." (Edmands 1970:162)

b. "Nurses, along with others, harbor stereotyped thinking regarding the poor, for example, that they have babies in order to receive higher welfare payments, that they are uncaring about bearing babies out-of-wedlock, or that they prefer large families. These stereotypes, in turn, are linked to the low esteem some hold for certain social, ethnic, or cultural groups." (Edmands 1970:160)

c. "The social distance between the professional and the public can be great enough to create problems. Sometimes it is difficult to initiate and maintain a feeling of mutual confidence, gain rapport, or convey concern and respect." (Edmands 1970:105)

2.) Communications may break down between the professionals and the target population.

a. "Program and clinic personnel should be wary of handing the young mother literature and expecting it to meet all her needs; because many women come from depressed school situations; they often read and comprehend on a 3rd grade level. (A recent survey of maternal health literature revealed that it is primarily geared to a 10th grade reading level.)" (Parenthood in Adolescence 1970:47)

b. "Professionals frequently discuss planning concepts that are unfamiliar to patients. Phraseology, sentence structure and length, and word usage may also create problems in communications. Technical terms familiar to professionals may have no meaning for the average person. Even simple words have different meanings among various populations." (Edmands 1970:105)

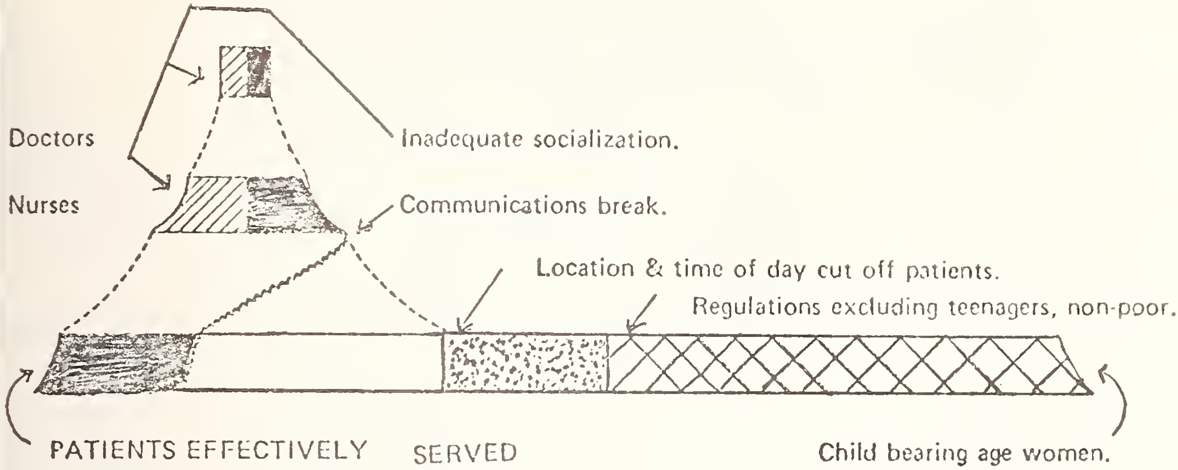
3.) The clinics can also be viewed as being ill-adapted to the social environment.

a. The target population may be limited-excluding teenagers, the non-pregnant, or the non-mothers. "About one-third of all teaching hospital obstetric departments and nursing schools approved giving family planning services to unaccompanied and unreferred teenagers in 1966-67." (Edmands 1970:114)

b. Many clinics are poorly located to the vast areas they are supposed to serve with deleterious effects. "One study found that if girls had to travel very far to reach the program, they dropped out." (Parenthood in Adolescence 1970:39)

c. Enough clinics operate during the same periods of the day as many governmental agencies that one concerned individual was willing to ask the following in a national nursing conference. "Why are clinic sessions like banking hours, from nine to three and closed on holidays? If we want to provide service for all patients, especially the working mother, evening or Saturday sessions are absolutely essential." (Edmands 1970:165)

Admittedly many agencies have been able to rise above some of these problems yet others have not. In any case, it seems appropriate to collect all the difficulties mentioned in a single model which reflects a "disorganized" clinic. (Adair 1972:4)



(Adair 1972:5)

Figure II

The patient faced with interacting in this structure confronts a maize of problems (i.e. regulations, instructions which don't communicate, nurses with curt remarks, and so forth). The obstacles in the way of patients and their typical reactions to them are important things to know if the "national goal of every child being planned" is to occur; frustrated individuals go away.

The Simulation

It seemed logical to design a simulation which would project a disorganized health clinic displaying client quandries that delay or impede service, a group of verbal responses from "clients" to a chain of difficulties, and a set of consequences for leaving the health care system. Several uses for one are apparent. By having young college students (in social welfare and nursing) behave as clients within such perimeters, insight can be generated into why those who need and want aid avoid the system. A recognition of system impediments is started before the student begins work as a professional. Hopefully this will help him to appraise actual clinics more perceptively and from a different perspective (namely the clients), to identify situations which can be subjected to change (appointment hours and etc.), and to understand with more empathy patient reactions.

Media developed took the form of a game board with the following components or sub-portions. First, obstacles were presented as a series of barriers between the health center and a starting point. (See Figure III)

	Return to Start	Go Back 2 Spaces	Return to Start		
Start	can not go	You can not ride a bus to the clinic	You have no car to go to the clinic.	FREE PARKING	Clini

(Adair 1972:21

Figure III

Each of the quandries, whether it is the area of transportation or communications, stops the client--a plastic object moved by a die and returns him to start. Mathematically the board was designed so that only a portion (one quarter) of the players make it to the clinic with any speed, while about another quarter tend not to arrive at all.

As the client lands on certain difficulties, instructions listed in a player's manual and on the game board force the client to draw reaction cards which express how they should feel (frustrated, angered, tired, determined and so on) and what to say out loud. One states, "These people pretend to provide services." The player reads this to himself and the oral response to the group. "A paper shuffling idiot is behind this. . ." In other words a static set of obstacles is made more dynamic.

Having often been delayed in reaching the clinic, forced into negative comments, and "hasseled" by the role of one of the players--a "judge" exists to torment participants as the social environment does somewhat--the client arrives at his destination. Being at the clinic does not promise the fulfillment of family planning goals. Here a second "obstacle field" begins. "You need an appointment." "Sorry the doctor is busy." "Your scheduled visit had to be canceled." (See Figure IV).

	Return to the clinic	Return to the clinic	Go Back 3 Spaces	
Clinic	Ran out of pills.	You did not understand the nurse's directions.	Doctor made you mad on the 2nd visit.	Health and Planning Goals

(Adair 1972:22)

Figure IV

Having reduced its liabilities (i.e. redoing the player's manual three times) and reproduced media, a larger, more rigorous test was held in a local health clinic (Polk County Florida on September 25, 1972). Data was collected both on a questionnaire created especially to measure the simulation's summative objectives and an evaluation schedule previously developed and standardized by the F.S.U. computer center (C.A.I.). Results obtained from a sample of 46 adults--25 Public Health Nurses, 11 Social Welfare Workers, and 10 others (paraprofessionals, midwives and medical librarians) supported two themes. The simulation yields cognitive achievement, as measured on a field testing instrument, and it produces positive dispositions in social workers and nurses. Six members of this combined group on an openended question expressrd reactions which could be interpreted as being negative ("boring," "awful" and etc.) While 23 were favorable. (For more explicit details see "Obstacle Course: A Field Test Report" by Charles H. Adair-Adair 1973)

From the Polk County data, yet another list of modifications was generated and acted upon. The number of cards was doubled with those indicating a trip to "Dropout Road" being color coded; and a rule was revised. These changes permitted a conclusion by the author, after further tests in Jacksonville and Gainesville, Florida, that nor design innovations are needed in its present form.

Comments

"Obstacle Course" is a finished simulation which can be applied in a setting where a person wishes to instruct others about "disorganized" clinics. All that it presently lacks is the collection of more empirical data to further indicate the degree to which the simulation achieves its summative objectives.

As a creation, the game's novelty probably lies only in its perspective. Obstacle Course inverts a situation for young nurses and social workers by having them behave in situations like their own future clients. It is hoped that others will consider similar approaches where individuals act out complementary roles rather than highly different ones. (For useful purposes, interns could appear as orderlies, health educators as nursing students, and so forth.)

It strikes the writer that more consideration is needed for simulations where lieutenants become privates rather than generals. Many great military commanders in history knew very intimately the state of their infantry. To fail to raises the specter of mutiny and "fragging". So too if significant goals are going to be achieved.

Adair, Charles H. and John T. Foster, Jr.
1972 A Guide For Simulation Design. Tallahassee: Instructional Simulation Design.

Adair, Charles H.
1973 "Obstacle Course: A Field Test Report," an Unpublished paper which may be obtained by writing to I.S.D., Inc., Box 3330 Leon Station, Tallahassee, Florida 32303

Chilman, C. S.
1968 "Fertility and Poverty in the United States: Some Implications for Family Planning Programs, Evaluation, and Research." Journal of Marriage and the Family. May 207-225

Edmands, E. M.
1970 A Report on the First National Family Planning Conference for Nurse's Education.

H.R.S. (State of Florida Dept. of Health and Rehabilitative Services.)
1973 "Number of Indigent Woman of Childbearing Age in Each County of Florida, and the Number and Percent Admitted for Child Spacing Services by Method of Contraceptive From Monthly Report of Activities of Florida's County Health Dept. Calendar Year 1972." Memorandum of the Bureau of Maternal and Child Health.

Merton, R.
1961 Contemporary Social Problems.

National Invitational Conference
1970 Parenthood in Adolescence. New Haven: Yale University Press

Real women at various points drop out of the state's program and so it is in the game. A portion of the reaction cards tell the client to give up. The player than transfers his "client" to yet a third set of trying situations; those things which might happen as a result of not "sticking it out." (See Figure V)

	Rest	Go Back 1 Space	Go Back 3 Spaces	
Dropout Road ________	Try Grandmother's contraceptive advice.	Try lead pellets to cause an abortion. Get sick.	Drop out of night school because of children.	________ Rocky Life

Figure V

(Adair 1972:22)

Field Testing

Both a problem and a teaching simulation ("Obstacle Course") have been briefly described. At this point, it seems logical to wonder". . . did the simulation work?" To this oversimple question the author could respond in similar vague manner, "No," "A little," "Somewhat," "Yes!" "Obstacle Course" has been field tested on six different occasions with college students (undergraduate and graduate) and professionals in local health centers. The first four tests were held at Florida State University during the summer of 1972 in the Department of Social Welfare. These early plays of the prototype were informal sessions composed of interested students most of whom were working on master's degrees. (The assumption being that advanced students would be harsher critics than the undergraduate target population.) The students would convene in a classroom, read the manuals, and play the simulation. While this occurred the author simply recorded the errors and mistakes made and the questions which arose. After completing the game, the designer explained its intent and requested their criticisms and comments (writing these as fast as possible).

Numerous difficulties happened in the first field test session: the playing cards were too complex--slowing down the action, rules needed to be added (situations happened for which there were none), and several instructions required rewording. As a consequence, the simulations objectives were not achieved due to the undertainty in the procedures and the cumbersomeness of the media.

The simulation was then modified between the first and second play based upon observation and intuition. Likewise, changes were built in between the second and third, and so forth.

SIMULATION AND GAMING AS AIDS IN REGIONAL AND INTER-COMMUNITY PROBLEM SOLVING*

Herman Sievering and James Sinopoli

College of Environmental and Applied Sciences
Governors State University
Park Forest South, Illinois 60466

ABSTRACT

Simulation/games (hereafter S/G) have been in classroom use for some time and are viewed by many as an effective teaching medium. Only rarely has any attempt been made to use S/G as an aid in decision-making (Duke, 1973; Feldt, 1973; Schran, 1972). In addition, the increased interest in citizen participation in the decision-making process makes it necessary that S/G be evaluated as a structure for involving citizens in the decision process.

The purpose of this paper is to (1) investigate the use of S/G as an implementable structure for involving citizens in community and regional decision-making and (2) describe an ongoing attempt to evaluate S/G as an aid in the regional planning and decision-making process.

INTRODUCTION

The basis for the theory and application described in this paper stems from a societal need for both communication and a communicator of totalities. Society exists as many different, overlapping, and multilevel communities in need of a communicator of the interfaces between those subsystems as well as the subsystems themselves. In addition, the need for broader base decision-making originates and is perpetuated by a similar value structure. Within that value structure is a striving for uniqueness, specialization, individualism and independence.

*This paper has been submitted for publication in Simulation and Games.

The effect of that structure upon our mental processes is fragmentation, compartmentalization, and a complete lack of overview or comprehension of a totality. For a community (people gathered together in a common locale, or with common interests, or under common law, or with common privileges), this value structure breeds narrower policy decision-making, disengagement, competition, ignorance of interdependency, exaggeration of individualism, and generally "The Pursuit of Loneliness" (Slater, 1970).

Decision-making in communities is hindered at two crucial points: (1) the framing and definition of problems (our failure to perceive or communicate totalities), and (2) narrow decision-making processes (our lack of participation and cooperation). Solutions to problems are limited by the definition and orientation of that problem. Simple solutions implemented to solve problems devined "out of context" actually complicate the problem. They eventually are the cause for the epitomy of bad management, i.e., severe and unexpected repercussions. The lack of a comprehensive problem definition is reflected in most community decisions being reactionary rather than anticipatory. Citizen disengagement in the community decision-making process is also responsible for narrow decisions. To expose that process and to encourage citizen participation in that process, a public forum for the education and involvement of citizens is needed. The environment for the necessary public forum should be conducive to the articulation of values and needs, exchange of ideas, amplification of differences, and the building of tolerating relationships.

S/G can be used to fill the void left by both these needs. Simulation is a tool to be used in avoiding fragmented decision-making because its replication of reality is more holistic. Viewing problems in a different context, i.e., in a larger perspective, generates different and usually better problem definitions. Of equal importance to this characteristic of communicating totalities is the use of the gaming environment as a public forum for citizen participation. With proper instruction and guidance, gaming participants can be made aware of alternative (and possibly more optimal) decisions reached through broad base decision-making. Their involvement in a social laboratory tests cooperation, engagement, and a sense of community as a means to produce broad base decision-making.

CITIZEN PARTICIPATION

Many governmental agencies and programs, social institutions, and academic research projects are committed to the general principle of citizen participation and involvement. EPA Director Russell Train in the keynote address to the National Conference on Managing the Environment said, "Turning now to citizen participation, I will state may absolute conviction that this is the single most important ingredient in the environmental management process. The environment is just too important to be left to us bureaucrats". The demand for citizen participation in policy formulation is on the upswing and many federal programs have specified the need for its inclusion. A basic assumption of the American system of government is that the best means for achieving long-term public support with minimum coercion is to involve the public in the decision-making process (Umpleby, 1972). These same programs are, however, so constrained by specific priorities and program guidelines that the result is an inhibition of participation by citizens. The final users or consumers - the citizenry - can never really criticize, evaluate, and direct the development and implementation of a product or process, so that it is of maximum applicability to their needs. Without constant feedback from potential users, any policy applications risk their relevance, accountability, and credibility.

The dichotomy between the structure of an existing project, plan, or program and citizen determination and input into that structure exists because of the ambiguity concerning citizen participation. Strategies of citizen participation have failed mainly because the involved project directors have: (1) no precise meaning of citizen participation, (2) no implementation structure as to how to involve citizens, (3) either lack the resources or lack knowledge of what resources should be used to organize and involve citizens, and (4) have not determined the extent to which citizens will have a voice in decisions. It is the last point that strikes at the dilemma in citizen participation; the demand for both participatory democracy and expertise in decision-making. In American society, symptoms of such a dilemma can be seen in the alienation of citizens to their government; students to their teachers, and consumers to industry.

What is needed from the inception of any program, plan, project, or institution is a continuing forum in which the expert directors and the potentially affected decision-makers, community leaders, and general citizenry can discuss and exchange ideas on the development and implications of the final product, technique, or process. Such a forum permits effective and fair reconciliation of diverse political and administrative interests. It can also provide for local or subcommunity differentiation while giving top priority to regional or community goals.

It is only through conflict generation, concrete discussions, and argumentation that effective solutions to social problems and needs can be explored. It is a characteristic of social needs and interests that they cannot be articulated by isolated individuals who are exposed to collective communication and direct confrontation with the situation which is under discussion. The normal case is that the isolated interview can only articulate his needs roughly and vaguely (Offe, 1969). A forum for conflict generation and resolution is then needed for proper definition of objectives and awareness of needs and values.

People know that effective participation and worthwhile involvement can, happen only within guaranteed coherent, long-range, and well-coordinated community programs which the participants and people concerned can easily control by themselves, economically, politically, and administratively, so that the experts play a secondary role (Kuenzlen, 1972). A community forum must be an ongoing autonomous activity. S/G offers participants an opportunity to view the urban setting as people gathered together for mutual advantage rather than a conglomeration of competitive and fragmented activities.

REGIONAL APPROACHES AND REGIONAL PLANNING

The gaming environment of S/G can be used as a community political and administrative planning device. Within that environment, participants can set objectives, decide on a means of attaining those objectives under the imposed constraints, and if the forum is ongoing, actually evaluate the results of their participation. The socio-political planning tool is interfaced with a technical planning tool: simulation. Technical regional planning involves assimilation of great quantities of abstract and technical data, exploration of viable solutions, and an implementation and operation phase. These technical planning phases must feed into and have feedback from the complementary political planning phases. Technical planning usually sinks under the weight of informative overload, and the inability to interrelate that information. Modeling and simulation are tools to be used in dealing with problem definition, informative overload, complex interrelationships, and the regional planner's never ending search for comprehensiveness.

The characteristics of technical regional planning invite a systems approach, systems analysis, and eventually modeling and simulation. Regional planning is concerned with the order of activities and channels in space and time. It is hardly ever concerned with the same space and the same time; thus the specific need for regional designation within a time frame. This gives rise to its features (and advantages) of being open and sub-systematic, along with the methods and tools of the profession, modeling and simulation among them.

SIMULATION

Large scale urban modeling has come under recent attack even though its development is in an embryonic state. Lee suggests that, "Contrary to what has often been claimed, what was learned has almost nothing to do with urban spatial structure; the knowledge that increased was our understanding of model building and its relationship to policy analysis (Lee, 1973). Modeling must be viewed in terms of its assumptions and limitations, and in comparison to other communications and planning tools. Model structure limits response of the system and solutions to problems and disturbances of that system. By assembling a model with real world data on the operational scale of the relevant system, one can begin to derive simulation of that model: (1) the relationships that appear to govern the interactions and, (2) the areas within the modeled totality where further research is necessary for comprehension (Commoner, 1973).

Urban simulation interfaced with gaming environments need not be "hypercomprehensive," predictive, or on a macroscale (Lee, 1973). They should be simple, descriptive, and aggregative, and be built with extensive quality control. Simulation's contribution to gaming is the re-establishment of an operational decision-making environment. A gaming environment offers the context in which individuals can begin to communicate with each other and learn how to interact with a "total" structure. Under today's conditions where elaborate systems govern outcomes, the individual must either devote considerable energy to establishing a context which permits assimilation of torrents of information, or failing this, be deprived of full participation in his environment. Without proper context he can neither comprehend his environment individually nor enter into dialogue about it (Duke, 1972).

S/G AND A REGIONAL APPROACH

The thrust of the argument on the use of S/G for regional approaches is that individual decisions in the gaming environment effect aggregate behavior within the simulation and, in turn, it is the description and attributes of simulated aggregates that are part of the informational basis for the individual game decisions. Gaming participants intuit in the context of a simulated totality. Any unexpected repercussions or "counterintuitive" results of the simulation are caused by the gaming participant's lack of properly communicating with the holistic environment. There are no "counterintuitive" results in a dialogue between an individual and a system if the individual comprehends the total system. The regional decision-making process (the feedback loop of individual decisions and aggregated behavior) is well replicated in S/G.

Besides the exposure of the regional decision-making process, such S/G reveals that good regional planning is dependent on the understanding of aggregate location factors. Although location theory is couched in the compu-er simulation, gaming participants are concerned with the relative advantages of location dealing with the growth and form of their region. In order to increase the probabilities of development in a desired location, participants must clarify their objectives, weigh the attractiveness and advantage of different locations, and design a means to influence behavior towards that location.

The direct involvement by gaming participants in the crux of regional planning (location advantages) plus their exposure to regional decision-making is complemented by gaming's ability to communicate the analytical technique of simulation directly to the user audience. Gaming has the capability to educate and motivate decision-makers to understand and use an interfaced simulation in assessing alternative solutions to urban problems. In the use of technology for regional problem analysis, the gap has proven too large between the groups that quantitatively analyze urban problems and the citizenry affected by these analyses (Thibodeau, 1973). S/G can begin to "teach" technology and its proper application. It is a vehicle for human communication as well as communicating systematic thinking.

APPLICATIONS

At Governors State University we are in the early stages of an S/G project which addresses both broad base community decisions and the avoidance of fragmented decisions. Our efforts are aimed at (1) establishment of an ongoing forum for the education and involvement of citizenry in community decision-making and the analytical tool of simulation and, (2) avoiding fragmented growth through a gaming forum that promotes a regional view of growth issues by being interfaced with a local region simulation.

Our concern over inter-community relations and fragmented growth arises from our locale. The University is a new state university in the federally insured new community of Park Forest South, Illinois. Both the University and the community are in an embryonic state, with the population of Park Forest South being only 4000-5000 and the University not even into permanent facilities. There will be tremendously rapid urban growth in the area until a saturation level is reached in 25-30 years. The new town is situated in the south suburbs of Chicago which is - governmentally - one of the most fragmented in the entire nation. Within a 20 mile radius of Park Forest South exist 40 governments. With such a fragmented governmental structure comes the concomitnat inefficient use of natural and human resources. Couched in these terms it is obvious that good regional planning is an important immediate need. The project goals are to promote regional planning and to avoid fragmented growth.

BIRTH OF A FORUM

Our first effort to establish a public forum in this community to promote regional planning, to avoid fragmented growth, to introduce community decision-makers to simulation, and to generally gain a community base, came at a series of workshops entitled Environmental Planning Workshops for Community Leaders (supported by OEE Grant 316-40-11). Two series of workshops were held with each series consisting of four workshops lasting 6 hours and having approximately 50 participants in each. Participants were leaders in local government, business, labor, community action groups, human service agencies, and legal agents.

Each workshop day consisted of two major portions: involvement in Richard Duke's METRO-APEX in the morning, with the afternoon spent in discussion of solutions to transportation, land use, and water problems and the integration of such solutions. Although APEX and the discussions were by themselves useful, it was the continuity between the two that was of importance. The discussion led to problem-solving approaches which could be tested in the APEX environment with the results from the game/simulation fed into the discussion of alternative solutions (See Figure 1: "Workshop Logic Flow Diagram").

The first workshop was initiated with the challenge that the next five years are the most critical to the future of Chicago's south suburbs. The simulation activity was then introduced as the best way to look at alternative futures by projecting ourselves through five years of our test community - APEX County. After an half-hour introduction to the simulation/game APEX and approximately an hour for introduction to their respective roles, participants completed the first of four cycles of APEX decision-making that being 1973 decisions.

Upon entering into the second cycle (decisions for 1974) participants' understanding of their roles in APEX and an appreciation of the need to allocate human resources efficiently was clear. However, coordination to arrive at cooperative decisions was still not emphasized. By the conclusion of this second cycle the mood was ripe to point out the need for clear cut guidelines to foster cooperative decisions. Thus, the functional discussions following this second cycle of APEX focused on essential elements of policy planning. It was at this point that the continuity between the functional area discussion and simulation first was fully recognized by some of the participants, for only at this point was the simulation appreciate as a true testing ground for policy planning.

Upon entering into the third cycle (decisions for 1975), simulation as a tool to test strategies, to test implementation of regional planning policies, and to look at alternative futures was appreciated. Having in hand guidelines for regional planning in the respective functional areas of transportation, water, and land use - each participant began to develop strategies for implementation from the perspective of his own role.

Two salient facts became evident at this point. First, the cooperation across roles was essential to any implementation program. Second, that planning by functional areas was not sufficient. The focus for functional area discussion then became:

1. What is the state-of-the-art in the planning for each functional area

2. How can functional area plans be integrated? and

3. How do we plan in a more holistic fashion?

The fourth and last cycle (decisions for 1976) became an attempt to implement integrated or systems planning with a follow-up discussion focusing on implementation strategies for the regional planning guidelines developed in the previous discussion. This last discussion brought forth the need to use simulation on a continuing basis as a tool in promoting the regional planning guidelines. The presentation of the need for an interpretive scheme for regional data further supported this point.

The results of the workshops were: (1) the introduction of a public forum and simulation to the community; and (2) the development of planning guidelines for the south suburbs of Chicago.

(The Workshop series with concurrent APEX runs also offered a normal and experimental audience to conduct research. We took advantage of this opportunity by conducting an experiment involving the use of the gaming environment as a social laboratory to test a representation structure as a means for better communication, articulation of values, cooperation, and more optimal decision-making. With only one of the two concurrent runs of APEX having this representation structure, both gaming decisions, and participants' interests and demands wer monitored and compared. Evaluation of this comparison between the two runs indicated truth in both hypothesis and theory; a representative structure breeds cooperation and better decision-making, and the gaming environment is a useful social laboratory).

After evaluation of the spring workshop, efforts have shifted to three fronts in preparation for the next series of workshops. These involve: (1) a local region simulation, (2) modification of the gaming environment, and (3) further community involvement.

In process now is the conversion and recalibration of the APEX data base and computer simulation. APEX is particularly well suited to a simulation of Will County (the County just south of Chicago's Cook County) since it has a population centrally located in the county (the city of Joliet with a population of 80,000) and a total population of approximately one-quarter million. Thus, APEX's central city becomes Joliet and the city/county political structure of APEX overlaps well that of Joliet/Will County.

It is considered essential that Will County citizens and decision-makers be integrally involved in this converison process. Unless this happens the finished simulation will have been developed in isolation with no community people aware of the simualtion model assumptions and limitations. This can only lead to failure in the long run for inappropriate questions (i.e., questions not recognizing the assumptions and limitations) will then be addressed to the overall simulation/game when community decision-makers are later exposed to it.

At Governors State University we are now holding a sequence of courses to: (1) complete the data base collection, (2) continue the process of involvement of community people, and (3) validate and verify the resultant Will County APEX. In the first of these courses a mix of students (2/3) and community people (1/3) will change the gaming data base and familiarize themselves with the simulation models. In the second course, more community people will be involved with several students observing the responses of Will County residents to their roles in the changed simulation/game. Follow-up courses will be aimed completed at community people.

Validation of data for sub-model internal consistency will occur during the first of the sequence of courses. A two-level verification program is intended. The major simulation model - the Lowry urban growth model - is being evaluated through an independent simulation program on the city of Joliet and its immediate surrounding environment (which accounts for most of Will County). The second and larger level of verification will begin in the second of the sequence of courses with observation of the response of Will County residents, observation of the fit of the overall data base to

Will County itself, and, most important, examination and evaluation of the fit of a five year projection (1970 to 1975) to the real county environment. For the simulation to contribute to the decision process it need only be operational and have macroscale accuracy.

It is considered important that the second of three fronts - modification of the gaming environment - be dealt with. Hardly any computer or manual simulation has yet allowed for the necessary depth of interaction with the data base to succeed in the involvement of community people to allow S/G to be functional and practical aid in decision-making. A computer game like APEX needs much more visual aid to complement the large amount of numerical data available to the gamer. The use of visual aids as found in the manual games C.L.U.G. or W.A.L.R.U.S. are very helpful but may still not be sufficient for the job (Feldt, 1973). We are soliciting the aid of our instructional communication and support staff to develop films, graphic arts, and other visual aids to complement the lego block visual of manual games. In the future we hope to use P.L.A.T.O. terminals (Umpleby, 1972) to move the gaming environment into the homes of Will County decision-makers.

Of course, these efforts will be of no real value unless people from the region being simulation and gamed take an interest in this project. The spring '73 workshops were a first step in this direction, the sequence of courses is the second step. By the end of this course series it is anticipated that twenty to thirty Will County residents and decision-makers will be actively involved. It will be at this point in time that a second workshop series is planned. Invitations to general citizenry but particularly to city and municipality managers, township supervisors, planning and environmental protection office staffs, and business/industry as well as land developer/realty representatives will be appropriate.

Projection beyond this stage is difficult, but it is hoped that the Will County APEX will have "taken root" and become an accepted aid in regional and environmental decision-making. In particular, an effort to involve the Will County Regional Planning Commission will be made. Achieving a broad base of involvement would then be important, with highest priority being placed on general citizenry use - thus addressing the felt need for a public forum.

CONCLUSION

A rationale for S/G as an aid in public policy decision-making on regional and environmental issues has been given with the suggestion that S/G can best serve as a public forum for the generation, discussion, and resolution of these problems - particularly considering the increased interest in citizen participation in the public decision-making process. The description of an attempt to achieve this task in Chicago's south suburbs has focused on the process of community involvement. Successful integration of S/G into community decision-making will depend upon the depth of involvement of the user at inception, during, and in the terminal phases of such an endeavor.

REFERENCES

COMMONER, B. (1973), "Alternative Approaches to the Environmental Crisis", Journal of the American Institute of Planners, May, 1973: 147-162.

DUKE, R. (1972), "Gaming/Simulation - A New Communication", Paper at the Third International Conference on Gaming/Simulation, Birmingham, England, July, 1972.

DUKE, R. (1973), Personal communication on the use of APEX in Hawaii, March, 1973.

FELDT, A. (1973), Personal communication on the use of W.A.L.R.U.S. in Traverse City, Michigan, March, 1973.

KUENZLEN, M. (1972), Playing Urban Games, I Press, Inc., Boston.

LEE, D. (1973), "Requiem for Large Scale Models", Journal of the American Institute of Planners, May, 1973: 163-178.

OFFE, C. (1969), "Sachzwang und Entscheidungspielraum", Bauwelt, September, 1969: 476-489.

SCHRAN, H. (1972), "Urban Systems Gaming - Development in Germany", Simulation and Games 3: 309-328.

SLATER, P. (1970) The Pursuit of Loneliness, Beacon Press, Boston.

THIBODEAU, R. (1973), "Who Reads the Output", Modern Data, January, 1973: 48-51.

UMPLEBY, S. (1972), "Is Greater Citizen Participation in Planning Possible and Desirable?", Technological Forecasting and Social Change, 4: 61-76.

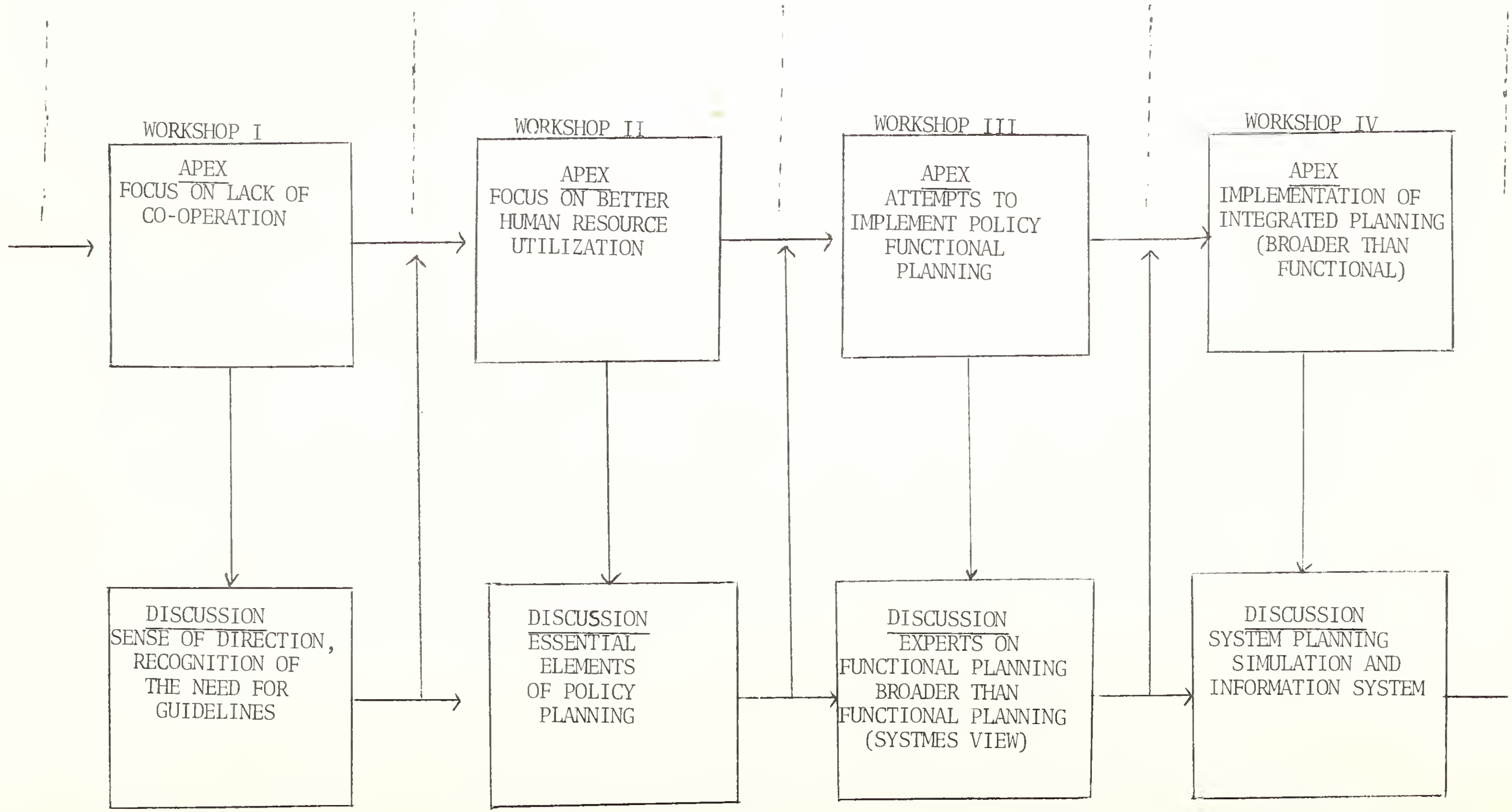


FIGURE ONE WORKSHOP LOGIC FLOW DIAGRAM

PAYING THE PIPER or PAY US AGAIN, SAM!

Stuart Cipinko
University of Redlands
246 Fourth Street
Redlands, California 92373

> "Metanoia. Man makes himself not in his own image, but in what he understands to be his best image. Simulation games can provide fresh images by which people can live. This will call for a ...tranformation of the whole simulation milieu...a new level of consciousness for a theology of liberation." (Wilcoxson & Washburn, 1972)

This quote appears in the second issue of Simulation/Gaming/News, the house organ of the gaming community. It sets out very clearly the normative paradigm in which many of us who use simulations labor--games are an agent of, and a vehicle for, radical social change. They are not neutral models of reality, but crucibles in which new, and hopefully better realities, might be forged. Implied in the statement is a philosophical commitment which transcends the merely instrumental use of simulations as tools, a metaphysic which places praxis above practice, metamorphosis before technos. Appropriately, the article in which these sentiments appear is entitled "Toward a Theology of Simulation/Gaming."

If this ultimate concern with values were a dominant theme on the current gaming scene, this paper would have no purpose. But unfortunately, and I think tragically, it is not. Since May, 1972, not a single article in S/G/N has examined the value implications of simulations; moreover, an examination of Simulation and Games reveals that in the three year history of that journal, no serious consideration of the ethics of gaming has been manifested by any of the contributors. If these journals are at all an indication of the present state of mind in the field, then its practitioners have suffered what is, at worst, a loss of nerve (in its most pejorative existential sense), or at best, a disturbing dissolution of critical self-consciousness. This paper, analytical in its form, but frankly polemical in its intent, is an attempt to call back the good in us from our immersion in a dangerous and insidious evil.

No human enterprise is conducted in a vacuum. Every human activity takes place in a social milieu which gives form to and imposes constraints on the exercise of creativity. There are three aspects of our current milieu which have especial importance for that form of activity called science, of which simulation and gaming are a special case: consensus, success, and history.

It is by now a commonplace that the conduct of normal science transpires within a conceptual paradigm about which there is minimal debate; the fact that science is done at all is proof that a consensus exists regarding the basic features of the world to which scientists turn their attention. But the ground of that paradigm is not, contrary to the canons of science, empirical; it is rather, metaphysical--a shared understanding about what "reality" is essentially like, and about the proper methods one must use to correctly understand that reality. Empirical evidence, then, is not so much a support of the paradigm as a result of it. (Kuhn, 1962)

It is not difficult to discern a parallel situation in the field of simulations. The literature on simulations and gaming concentrates overwhelmingly (I am tempted to say totally) on two things--the creation of new forms (the hardware, if not the currency, of the discipline), and the evaluation of the instrumental efficacy of those forms, e.g. how does it change the behavior of those involved, how much (only in a very limited sense what) is learned, what is its value for future research? These, of course, are not unimportant considerations, but these questions could not even be asked if there were not a prior (perhaps a priori) understanding that simulations are supposed to be useful, that they are, in fact, means to a greater end. And it is in this conception of simulations as means that the heart of the paradigm lies.

A means-end relationship is not merely (or even primarily) a logical imperative; it is, rather a technical necessity. The notion that means and ends are separate cognitive categories is the product of what Jacques Ellul has called "technique consciousness," which develops in "a world once given over to the pragmatic approach and now being taken over by method" (Ellul, p. 15). Technique is, in Ellul's words, "the mind of the machine;" it is "the translation into action of man's concern to master things by means of reason...make quantitative what is qualitative...take hold of chaos and put order into it." (Ellul, p. 43) In this process of rational mastery of chaos, all value questions are reduced to a single consideration: does it work? If the answer is affirmative, all other questions become irrelevant.

If the literature on simulations is an accurate reflection of the sentiments of those who practice them, then it is clear that we have become prisoners of technique. We are purveyors of a new technology, and the form of that technology (the very fact that it is technology) compels us to adopt the world view in which all things are measured by their efficiency, all worth determined by a narrowly defined "usefulness." And so we concentrate on improving our delivery systems and perfecting our feedback mechanisms, with efficiency as our guide, and a naive understanding of productivity as our goal.

All of this would be of little moment if the subjects of our efforts were non-reactive entities like molecules, or unfeeling forces like energy and inertia for which the tools of a technological society were expressly designed. But our subjects are people; our techniques are employed on those whom, when we are not acting as professionals, we normally treat as worthy, self-respecting individuals. As professionals, however, caught up in the heady power which sophisticated techniques give us, these people become objects to be manipulated. No matter how open the game form, no matter how non-authoritarian the facilitator, the unequal distribution of knowledge in a gaming situation places the game director in a potentially manipulative position. It is in the debriefing, where the learning should take place, that the manipulation is most subtle and most damaging, as the facilitator tries to draw the participants into an understanding of their experience that reflects his or her own interpretation of what happened. The most benign motives in the world do not change the fact of differential power, and I wonder if even the most saintly among us has the right to force people to be free.

This manipulative capacity, and the technical consciousness which impels it, would not be so dangerous if the larger society in which it operates were inimical to its exercise. If we were forced to fight for our right to manipulate, we might be more inclined to think seriously about what we were doing. But exactly the opposite is the case. It is no accident that simulations and gaming are now the calling-card of "innovative" education; it is no accident that "radical" educators are employing games as teaching tools almost as fast as they can be turned out; it is no accident that the agents of corporate capitalism are incorporating simulations into manager training programs; and it is certainly no accident that substantial government funding is going to those who produce and refine the tools of the trade.

The coming of age of simulation research dovetails nicely with the coming of age of behavioral psychology. Both are presented as a radical departure from traditional methods of learning and knowing; both emphasize heavily the technical innovations which make the new approach possible; both insist that the burden of change be shifted to the subject from the expert; and both talk about behavioral modification as if that label described an unmitigated good akin to divine revelation. And both work--if one goes through the right steps, follows the guidelines, uses the proper jargon, one gets results. Call it insight, call it learning, call in conditioned response--one gets <u>change</u>, and that's what counts.

But change is not necessarily either radical or good. Change supported by those very institutions most dedicated to preserving the *status quo* should be immediately suspect; only a political naif can really believe that the master institutions of a society would work deliberately to undermine their own existence. Simulation research is supported because it creates a kind of change peculiarly resonant with the ideology of a liberal, technological state--quantitative change rather than qualitative, change *an sich* rather than change *für sich*.

The only thing more damaging to the morality of an enterprise than abject failure is success. Success is the most obvious kind of positive reinforcement; it tells us in the only terms our society allows to understand, that what we do is good. And since this validation reinforces our own self-perception (no one wants to think that what she or he does is bad), we continue to do that for which we are rewarded, we accept other's definitions of the good, and we cease to question our own activity. We are, effectively, bought off.

None of this should really be surprising if one considers the historical background from which the present state of the art arose. It is a notable fact that developing sciences tend very quickly to forget their origins. In their preoccupation with the present, the practitioners of a new science search frantically for respectability, and rewrite their histories to more closely correspond with the enlightened understanding to which they aspire. So physics and chemistry do not dwell on their beginnings in alchemy and magic; economics downplays the importance of its early philosophers to concentrate on the newest developments in stochastic analysis; sociology forgets its genesis as the reactionary response to the French Revolution. And simulation/gaming does not confront its derivation from the attempts of the military to improve its capabilities for making war.

It is richly ironic that the radical and liberating possibilities which so many see in simulations should derive in large part from that sector of society most consistently *dedicated* to conservatism and repression. One can say, of course, that the present work in the field has transcended its origins, but such a statement strikes me as both short-sighted and inaccurate. The military, whatever its reactionary tendencies in other areas, has always been a champion of technological innovation and efficient management. The proliferation of arms, each one bigger and better than its predecessor, is almost a model of technical consciousness gone mad. The nearly obsessive desire to find new and less wasteful ways to kill people is an example of the efficiency ethic with a vengeance. And the military is the pillar of what Alvin Gouldner has called the Welfare-Warfare State, the institution most closely allied with the state both financially and philosophically.

I do not mean to suggest a parallel between simulators and the military. The former are considerably less numerous, and infinitely less powerful. But there seems to be, to some extent, a shared consciousness--one that exalts technique over meaning, innovation over insight, rhetoric over reality. There is a serious danger here--technical consciousness creates the world in its own image, replacing human values with machine values, so that it becomes difficult to tell <u>why</u> we are doing something as long as we continue doing it. It is in this kind of consciousness that war can become peace, and manipulation freedom.

If we are to escape the trap into which this technological preoccupation would lead us, we must reclaim human values as an explicit and crucial aspect of any simulation experience. We must recognize that simulations are not, and cannot be, value-neutral tools, that they imply a construction of reality for which we, as facilitators or directors, are responsible, and to which, by our very presence, we lend credibility. And this burden demands that we become ethically sensitive as well as technically expert.

We are not philosopher-kings, and we should not pretend to be. We are not objective observers, detached from a world we help create, and we should not pretend to be. And, since no one completely escapes the onus of the past, we cannot be radical innovators unless we work at it self-consciously--and this we <u>can</u> strive to do.

References

Ellul, Jacques. The Technological Society. Vintage Books (New York, 1964).

Kuhn, Thomas S. The Structure of Scientific Revolutions. Phoenix Books (Chicago, 1964).

Wilcoxson, Georgeann and Washburn, John. "Toward a theology of simulation/gaming." Simulation/Gaming/News. Vol.1, No.2, May, 197

PUBLIC POLICY APPLICATIONS

George McFarland
Simulation Sharing Service
Morgantown, West Virginia 26505

Simulations are useful tools for training citizens in the complexity f governmental administration and decision making. They have also demonstra-ed usefulness in the areas of assisting citizens to examine viable alternatives o self-centered interests, developing strategies for responsible and ffective involvement in governmental decision making, in raising the onsciousness level of community people to local, state, national issues and roblems. To our knowledge there are at least 15 groups (centers) in the U.S. hat are using simulations to educate and/or sensitize citizens to community ssues/involvement. There may be others. The particular target groups of hese centers are: unions, clubs, special interest groups (eg. W.R.O., chool Bond Issues, Housing, Church, League of Women Voters), continuing ducation, neighborhood coalitions and home extension.

Continued involvement with these groups is anticipated for the fore-eeable future because a number of citizens are becoming increasingly interested n learning <u>how to</u> have an impact on their local government. Public media, hurch programming, union publications, revenue sharing and personal nconvenience or suffering related to public policy are all contributing factors o citizen interest in the process of public policy formulation. The imulations listed below are intended to begin a list of the kinds of simulations hat have <u>demonstrated</u> some usefulness in the overall process of developing larger group of informed, sensitive and active citizens in government (primarily ocal). We know that these simulations contribute to the above category of itizens. Our use of these simulations indicates our belief that our country eeds this kind of citizen.

1. Whipp - simple look at causes underlying housing problems.
2. Welfare Week - experience of being on welfare. *GSI
3. Power Play - understanding the dynamics of power.
4. Urban Dynamics - basic structures of interlocking systems in growth and development of urban areas. *C/G
5. Policy Plan - develops community involvement about a particular concern (Frame Game).
6. P.U.D. Exercise - demonstrates need for comprehensive land planning. *B.S.
7. Ghetto - sensitizes middle class to some ghetto problems relating to quality of personal lives. *C/G
8. New Town - introduction to the relationships between politics and economy of urban areas. *C/G
9. The Poverty Game - deals with welfare myths.
10. Much Ado ABout Marbles - difficulty of effective government, communications, cooperation and trust (Frame Game). *GSI
11. The Pollution Game - basic introduction to land use and environmental quality. *C/G

12. Serfdom - explores power systems based on straight line management policy (Frame Game). *S/S/S
13. Metro-Apex - aid to citizen participation in governmental process. *C/G
14. Community Interaction Game - development of political strategies and tactics. *C/G
15. Richland U.S.A. *St.L.
16. Starpower *C/G
17. CLUG - urban and regional economic, politics and sociology (Frame Game). *C/G
18. Yes, But Not Here - basic model of community organization (Frame Game). *C/G
19. Polis *C/G
20. Policy Negotiation Model - analysis of political situation (Frame Game). *C/G
21. Compacts - urban social service system-community organization (Frame Game). *GSI

Let me emphasize that this list of simulations is not a suggested list of materials that might be useful in recruiting (training-developing) informed citizens. This list could easily be used for classroom teaching (and many often are used this way). The games on the list have been used successfully by some groups. This means that others may also find these simulations successful. In other words, they are field tested. If you are finding it difficult to develop informed, responsible citizens' groups in your community, you might want to consider employing some of these simulations. If you wish help in learning how to use some (all) of them, then that sort of training can probably be provided by many (or all) of the 10-15 active training centers. Larry Coppard has the most current list of the centers that we know of today. His address is: P.O. Box 134, Park Forest South, Illinois 60466.

*Description contained in:

GSI - Gamed Simulations, Inc., Brochure

C/G - Contemporary Games

B.S. - Barbara Steinwachs

S/S/S - Simulation Sharing Service, October/November Issue, 1972

St.L. - Saint Louis Simulation Games Center

MASSIVE MANAGEMENT GAMING

Richard F. Barton
College of Business Administration
Texas Tech University
Lubbock, Texas 79409

Management gaming to educate college students for business careers has been with us for 15 years. Management games have emerged in many varieties and for many applications. One type of application that is slowly emerging involves very large numbers of students. To reach thousands of students with management gaming, what changes must be made? What is lost? What is gained?

Management games come in two general types: general and functional. Functional management games train participants to make decisions in separate specialized functions such as marketing, production, and finance. General management games reveal to players, through decision experience in managing a simulated company, the interactions among the separate specialized functions. Most general management games emphasize the "totality" or wholeness of business organizations. Players also learn by very real experience the difficulties of keeping small groups of persons on track toward objectives.

Usual Organization of Management Gaming

The structure of most management games is two or more companies interacting competitively in a single industry. Each company is managed by a team of players who try to interact coordinately to reach team decisions. The decisions of each team affect the outcomes of all teams. Most management games are now computerized. The computer model receives decisions from teams and computes interactions and consequences that are fed back to participants in the form of financial and environmental reports. These reports plus instructions from the game administrator and rules of the game from a player's manual are the basis for the next round of decisions. Play progresses until some desired number of periods has been simulated, usually representing several years of operations of the firms in the industry. Figure 1 shows a blank decision sheet. See Figures 2 and 3 for illustrative company and industry reports. In some applications, special team activities such as written reports or oral presentations are required of players to support team decisions. Also, the internal structure and organization of teams can be manipulated as desired for behavioral learning purposes.

The number of firms per industry may range from one to nine, depending on the game selected. Of course, one firm per industry is a monopoly and there is no competitive interaction among firms--the "solitaire" of management gaming. Any number of players may make up a team. Most authors recommend from three to five members per team for games of moderate complexity. Plays of management games may last a few days in executive development programs or entire quarters or semesters in college courses. Management games have found popularity in junior and senior business courses with class enrollments limited to 20 to 50 students. A class of 20 students can be accommodated in a single play of a management game by 4 interacting

THE IMAGINIT MANAGEMENT GAME

DECISION SHEET

Firm ________

Year ________

Quarter ________

Month ________

Company Name: ______________________________

	Market A		Market B
Product Names:	________ A-1	________ A-2	________ B-1
Prices	$.	$.	$.
Materials inputs per unit	$.	$.	$.
Salesmen	$	$	$
Advertising	$	$	$
Product research and development	$	$	$
Materials to be ordered	$	$	$
Units to be produced			

Employee fringe benefits per hour	$.
Dividends per share to be paid	$.
Operations research	$
Short-term loans Borrow (Repay)	$
Bonds Issue (Redeem)	$
Shares of stock to be offered	
Factory capacity Purchase (Sell)	$

Draw a wavy line through product columns not used.

If assigned, write decision rationale on reverse side.

Decision deadline ________

____

Team members sign names and titles below.

____
Decision recorder

____
Rationale recorder (if any)

________ ________

________ ________

Figure 1. Player's Decision Sheet

The Imaginit Management Game Year 1 Quarter 0 Month 0
BA 120 First Practice Decision for A-1 Detergent Only 10:30 Class

Company Report for Firm 84 Income Statement	A-1	A-2	B-1	Totals
Shipments in Units of Product	3180153.	0.	0.	
Net Sales Revenue	21109949.	0.	0.	21109949.
Cost of Goods Sold				
Direct Labor ($)	3850000.	0.	0.	3999012.
Direct Materials	7166667.	0.	0.	7166667.
Storage				446590.
Factory Depreciation				500000.
Other Factory Overhead				850000.
Cost to Manufacture				12962269.
Change in Finished Goods on Hand ($)	-523954.	0.	0.	-523954.
Cost of Goods Sold				12438315.
Gross Profit on Sales				8671634.
Salesmen ($)	1350000.	0.	0.	1350000.
Advertising	2100000.	0.	0.	2100000.
Research and Development	0.	0.	0.	0.
Employee Fringe Benefits	385000.	0.	0.	383267.
Operations Research				0.
Administrative Overhead				834842.
Interest				120000.
Profit Before Income Tax				3883525.
Income Tax				1864092.
Net Earnings				2019433.

Dividends per Share	3.00	Total Payout	900000.	
Shares Sold	0.	Proceeds	0.	
Change in Stockholders Equity				1119433.

Balance Sheet

Cash	3760372.	Accounts Payable	1685020.
Accounts Receivable	1897615.	Short-Term Loans	0.
Materials	1133333.	Bonds	2000000.
Finished Goods	1892154.	Paid-in Capital	14000000.
Net Plant	12600000.	Retained Earnings	3598455.
Total Assets	21283475.	Total Equities	21283475.
Common Shares	300000.	Book Value	58.66
Market Quote	83.97		

Current Policy and Environment	----A----	----B----	
Average Industry Prices this Period	6.70	0.0	
Current Total Market Demand (Units)	15754025.	0.	

	--A-1--	--A-2--	--B-1--	
Share of Market this Period	0.210	0.0	0.0	
Potential Shipments next Period	3441473.	0.	0.	
Prices	6.65	0.0	0.0	
Materials inputs per unit ($)	2.15	0.0	0.0	
Materials on Hand ($)	1133333.	0.	0.	1133333.
Materials on Order ($)	0.	0.	0.	
Months until Materials arrive	0.0	0.0	0.0	
Production levels (Units)	3333333.	0.	0.	
Number of Finished Units on Hand	553181.	0.	0.	
Distribution Channel Inventories	121044.	0.	0.	

Figure 2. Company Report for Each Team

Figure 2. Company Report for Each Team

Purchase or Sale of Factory Capacity			600000.
Loans Made or Repaid	0.	Bonds Issued or Redeemed	0.
Quarters Dividends too Low	0.	Total Dividends to Date	900000.
Firm Labor Rate	3.50	Actual Labor Hours	1095050.
Fringe Benefits per Hour	0.35	Probability of a Strike	0.03
Current Number of Labor Shifts	2.	Persons Available per Shift	252.

The Imaginit Management Game Year 1 Quarter 0 Month 0

End-Of-Period Industry Report

BA 120 First Practice Decision for A-1 Detergent Only 10:30 Class

Company Report for Firm 81	A-1	A-2	B-1	Totals
Share of Market this Period	0.198	0.0	0.0	
Prices	6.65	0.0	0.0	
Materials Inputs Per Unit ($)	2.10	0.0	0.0	
Advertising	2000000.	0.	0.	2000000.
Salemen ($)	1350000.			1350000.

Quarters Dividends Too Low 4. Total Dividends to Date 0.
Common Shares 300000. Book Value 60.78
Market Quote 60.26

Company Report for Firm 82	A-1	A-2	B-1	Totals
Share of Market this Period	0.212	0.0	0.0	
Prices	6.70	0.0	0.0	
Materials Inputs Per Unit ($)	2.00	0.0	0.0	
Advertising	2300000.	0.	0.	2300000.
Salesmen ($)	1300000.	0.	0.	1300000.

Quarters Dividends too Low 4. Total Dividends to Date 0.
Common Shares 300000. Book Value 62.35
Market Quote 64.33

Company Report for Firm 83	A-1	A-2	B-1	Totals
Share of Market this Period	0.176	0.0	0.0	
Prices	6.60	0.0	0.0	
Materials inputs Per Unit ($)	2.05	0.0	0.0	
Advertising	1800000.	0.	0.	1800000.
Salesmen ($)	1300000.	0.	0.	1300000.

Quarters Dividends too Low 0. Total Dividends to Date 900000.
Common Shares 300000. Book Value 58.87
Market Quote 85.10

Company Report for Firm 84	A-1	A-2	B-1	Totals
Share of Market this Period	0.210	0.0	0.0	
Prices	6.65	0.0	0.0	
Materials inputs Per Unit ($)	2.15	0.0	0.0	
Advertising	2100000.	0.	0.	2100000.
Salesmen ($)	1350000.	0.	0.	1350000.

Quarters Dividends too Low 0. Total Dividends to Date 900000.
Common Shares 300000. Book Value 58.66
Market Quote 83.97

Figure 3. Industry Report for All Teams

Figure 3. Industry Report for All Teams

Company Report for Firm 85	A-1	A-2	B-1	Totals
Share of Market this Period	0.204	0.0	0.0	
Prices	6.90	0.0	0.0	
Materials Inputs per Unit ($)	2.10	0.0	0.0	
Advertising	2250000.	0.	0.	2250000.
Salesmen ($)	1300000.	0.	0.	1300000.

Quarters Dividends too Low 4. Total Dividends to Date 0.
Common Shares 300000. Book Value 61.99
Market Quote 63.39

instructions for within team structures or for presentations and reports by teams are possible only if made uniform for all teams. Because so many teams can only be treated uniformly, the same "industry" must be simulated in all parallel plays within the auditorium. Absenteeism on decision days and enrollment changes by students dropping and adding the course after teams are organized require rules for handling missed decisions and for adapting within teams to absentee role players. Surveillance by the teacher of individual team activity is practically impossible. Yet, simultaneous exposure of thousands of students of business to actual decision making with irrevocable (though simulated) consequences has been done.

Large course sections usually appear at freshman and sophomore levels. Thus massive management gaming may be desired or needed only for introductory courses while the usual organization described earlier is more suitable to advanced courses. The principal purposes of a general management game are to integrate and to put together previously learned knowledge--to let the student experience how all parts of a company fit together in interaction to produce ultimate profit and other consequences. So how can beginning students be expected to play a management game before they have learned anything about business? The answer is quite literally "jump in and swim." Extra practice decisions and a good player's manual are called for. Here is a situation where simulation-gaming can really prove its merits. When beginning students make decisions for such elements as product quality and prices, stock issues and bond offerings, salesmen and advertising, purchasing and producing, dividends and plant investment, they learn the language of business. When they see consequences in the form of income statements, balance sheets, and flows of funds that look like the annual reports sent by corporations to their mothers and fathers, they learn how business decisions affect business results. When these results are tied to simulated stock market quotations, to shipments of their products, to shares of their markets, to probabilities of strikes, they learn the responsibilities managers must carry. These things students can learn without ever having a first course in accounting, marketing, finance, or production.

An Illustrative Implementation

At Texas Tech University during the fall semester of 1972, THE IMAGINIT MANAGEMENT GAME was implemented with 900 students divided into two sections of an introductory course called Business Enterprise. No laboratory sections were available. The course carried two pass/fail credits so grade motivation for game participation was absent. The two sections of the class met in an auditorium seating about 450 students. The course consisted of lectures by the dean and by guests and the management game. For the game, students were organized into 45 industries of 20 students each. There were 4 members per team and 5 teams per industry. Students had assigned seats and were assigned to teams on a side-by-side basis from left to right for the first row, then continuing right to left for the second row, left to right for the third row and so on. This way team members sat close together during class time. Decisions were required once a week. Four complete class sessions were devoted to explaining the game. During teams of 5 players or by 5 teams of 4 players. A class of 45 students can be accommodated by a single play of 9 teams of 5 players. A class of 50 students can be served by two parallel plays of 5 teams of 5 players. Several classes of 20 to 50 students each using parallel plays can provide gaming experience for a single course for one or two hundred students per quarter or semester. This organization provides a sizable exposure of business students to management gaming. Let us examine the resources required.

First, computer service and an assistant to handle the decision input and computer printout may be necessary. However, since the instructor for each class may be supervising at most ten teams, he may perform his own computer chores. He can be helped if players keypunch their own decision cards. Helpful in this circumstance is having the computer program cataloged in the computer library so that only the data carried over from the last decisions and a very few computer control cards must be handled by the instructor.

A desirable administrative characteristic of a computer game model is provision for different team numbers for each parallel play so computer output is not mixed up. Another desirable feature is simulation of different industries, both during a semester and from semester to semester. This way players cannot claim to learn and tell secrets of the game (even though the may be wrong about the secrets). If possible, consequences should come out of the computer in a way that minimizes hand sorting of computer paper.

Management gaming teams may meet in corners of the classroom, in separate rooms during the class hour, or privately outside of scheduled hours. Usually, the teacher tries to be available to answer questions before decision deadlines.

Changes to Accommodate Massive Numbers of Students

Consider now reaching over a thousand students per course through management gaming. How much of the usual organization described above can be retained? What adjustments must be made to accommodate these large numbers of students? What is lost? What is gained?

Course enrollments of a thousand or more frequently mean giant lecture sections given in classrooms or auditoriums seating 200 to 1000 students. One approach to management gaming for numbers this large is breaking the course into laboratory sections with few enough students to implement the usual organization of management gaming just described. This multiplies the administrative burden per teaching assistant because teaching assistants usually handle more laboratory sections than teachers handle course section

Another possibility, where laboratory sections are not available or desired is massive management gaming in the auditorium itself. Parallel plays of the game become a necessity to accommodate all the students. Separate firm numbers for each team help avoid mixing up the computer paper. An assistan to perform computer courier and paper handling chores is needed. Special this time three practice decisions were made. After official play started, 6 years of official decisions were simulated.

To handle the logistics of massive management gaming in an auditorium a "captain of industry" was appointed for each industry (a group of 20 students). This "captain" was responsible for receiving the computer output for his industry and distributing it to teams. Each team distributed computer pages to its own members. Therefore, to distribute computer output the game administrator was dealing with only 45 persons. Computer runs were made on multiple-copy paper. Paper separating tasks required about one hour a week. Key punching required one to two hours a week. Reruns due to keypunching errors required another hour a week on the average. Distribution of computer output was accomplished by placing the computer pages for each industry in an envelope. During class, "captains of industry" were asked to come forward and remove their computer outputs from the envelopes and leave the envelopes with the game administrator.

Written reports were required of each team during the semester. These were an initial and final team organization report and an initial and final overall policy and strategy statement. Also required were "decision rationales" written on the reverse sides of decision sheets. To avoid one or two players on a team from dominating the others, leadership roles for each of these assignments were rotated so each player was the team leader at least twice. (To further spread participation, the role of "decision recorder" was also rotated within teams). A reading of the written reports and decision rationales revealed that these beginning students were indeed learning sophisticated concepts related to business and industry without explicit "course" instruction in these concepts beyond the management game player's manual.

Teams were scored on the basis of simulated stock market quotations within an industry. Team and industry standings were reported periodically during the semester. A reward in the form of a certificate of excellence was given to each player on each winning team. Since there were 5 teams per industry, 20 percent of the students were winners. The questionnaire at the end of the course elected the management game as the most outstanding feature of the course.

In the spring semester, a similar implementation was made with 300 students in a single section (this being primarily a fall course). In this instance 3 teams per industry were used resulting in one third winners.

References

Barton, Richard F. THE IMAGINIT MANAGEMENT GAME. Lubbock, Texas: Active Learning, P. O. Box 16382, 1973.

"What's Wrong with the Introduction to Business Course?" Computing Newsletter for Schools of Business, Vol. III, No. 7 (March, 1970), School of Business Administration, University of Colorado--Colorado Springs, pp. 1-3.

SIMULATING SEXISM: UNINTENTIONAL (?) REPLICATION OF REALITY

Nancy D. Glandon
University of Redlands
Redlands, California 92373

During the session "Evaluating Simulations and Games" at last year's symposium I raised a question about the sex of the participants in various roles in one high school simulation of local government. Both the answer by the speaker and the reaction of the audience to my questions have caused me to ask the same underlying question again: do simulations[1] and our debriefings of them perpetuate real world sexual discrimination? And, if so, how do they do it, and what are we, as game users and designers, doing about it? The response of the speaker last year was something like "well, yes, boys tended to be in the higher status, decision-making positions and girls seemed to be concentrated by choice in supportive, lower-status roles, often functioning as secretaries." The reaction of the audience was amusement -- with some raucous laughter -- that the question was even posed, and seemingly one of "well of course" when the answer was given. At no time was it suggested that this particular parallel with 'real' reality was shared with the high school participants. My purpose here is not to accuse those particular simulation directors of chauvinism - either intended or inadvertent - but to examine the possibilities of sexism in simulations and in their use in more general terms. And perhaps, in so doing, accuse us all.

While simulations and games have been variously defined, a common element to all definitions seems to be that they are partial reconstructions of reality, designed to illuminate in miniature the processes of behavior, attitude formation, and deci-ion-making. There are probably as many definitions of sexism as there are of simulations -- but generally sexism refers to attitudes, behaviors, and structures which limit, deny, or prescribe certain attitudes, behaviors, or statuses to men or women. Assuming these definitions to be accurate, there is only one other assumption necessary (which is at least as valid as the former): there is sexism in our society, and therefore there is sexism in the realities of society which simulations attempt to reproduce. So, to the extent that simulations are accurate reconstructions of society, we can conclude that they are accurate reconstructions of sexism as well. And, to the extent that simulation designers, directors, and participants are products of an admittedly sexist society, they can be expected to exhibit sexist behavior and attitudes in their simulation experiences - in their decision-making, and in their perceptions of decision makers.

---

[1]This paper is primarily concerned with simulations used in teaching and community insight, rather than with simulations used for research purposes, although similar comments would be appropriate there, too.

Sexism in simulations can, I believe, take two forms: first, a reconstruction direct from society -- or what could be called 'simulation' of sexism; second, an introduction into the simulation itself either through the particular structural components of the game or through the attitudes and behavior of the director and/or participants during the playing of the game and/or during the debriefing -- or what we can call an 'acting of sexism' within the simulation. Obviously these categories are not mutually exclusive, and behavior and attitudes called sexist are likely to occur in both realms simultaneously.

The interrelationship of these two realms becomes clear when we try to look at particular simulations and spot overt and covert sexism. I would like to examine the existence of sexism in game structure, the possibilities of alerting structures of games to deal head-on with sexism, and the process of debriefing as a means of exploring sexism, either in the simulation structure or within the acting out of the game.

Sexism is built into the structure of games in a number of ways:[2]

- in role descriptions which become stereotypes of male/female attitudes;
- in role assignments where the director suggests or assigns certain positions based on her or his perceptions of 'predictable' responses of males or females.

---

[2]One recent example, "Remote Island," reported in the May 1973 issue of Simulation/Gaming/News (Cohen), contains five role titles and descriptions: four are male, one female. Three of the four males are given both first and last names; all four are given attitudes which favor or oppose the issue at hand. All four have a predictable economic interest in the decision.

The one role for a woman reads: "Mrs. Homington. Your name is Mrs. Homington and you are a *housewife and mother*. You represent a group of housewives who are interested in the processing plant and whether it comes to the island. You *listen* to the arguments and *ask* questions, because *you want to decide whether* to support or oppose its coming." (p. 11, italics added)

This last role (given last in the article too) is the only role where a vested interest for a certain side is not given; it is the only role where marital status is mentioned; it is the only role which suggests to its players that the appropriate strategy is to listen and wait - to be essentially passive. I am not suggesting that housewives should not be included in the roles used in simulations; I am concerned however that this is too often the only role which is viewed as 'appropriate' for women. And if in certain cases the game designer would view the simulation as 'less real' if the active powerful roles were neuter or female, then it seems to me that it is incumbent upon both the designer and the director to point out that fact of reality, and discuss its implications with the participants. I caution though that such a decision may be a cop-out, letting both the designer and the director slip comforably into a world they prefer and find easier to game.

in directions given or suggestions made which affect either the sex of the role occupant or the behavior required for such a role;

and in the labeling of the role titles themselves.

Many popular simulations contain role titles such as congressman, chairman, councilman; most descriptions use he, him, his exclusively. While we tell ourselves that such usages refer to 'man' in the generic sense, research on college students suggests that for students at least 'man' is interpreted as meaning 'male' rather than 'people' or 'all human beings.' Studies by Schneider and Hacker (1973) indicate that use of a generic label "may serve to 'filter out' women, largely by suggesting imagery appropriate only or primarily to men." (p. 12) Both theory and research in fields such as sociology and linguistics have maintained that social reality is defined and constructed through the use of symbols, and that language, as a specific system of such symbols, is linked to the creation and perpetuation of a particular perception of reality. It is time for game designers to examine their own perceptions of the sexual reality they present through their simulations.

Certain simulations such as the "High School Game," the "Marriage Game," and "Ghetto have built into them constraints which differentially limit the options available to females and males. All three of these games contain incredible possibilities for discussions of differential life chances faced by women and men. I wonder how often we as game directors turn the debriefing of these and other games to such issues.

It is also possible to take other existing games and make the sexism obvious, and of central concern. One such attempt on my part is described in detail in an article "Sexism: Rigging SIMSOC to Make the Point" (1973). Using Gamson's basic model of inequality, differential access to resources, and limited communication, I increased the realism by introducing sexism into the game structure: all heads of groups and all travel and subsistence agencies were assigned to males; all members of the ghetto region were women. The participants respond with typically social class-based reactions to the situation of women, and are unable to deal with it except through tokenism.

Throughout the simulation a certain amount of sexual consciousness-raising occurs: some men become aware of their own'liberalism' in 'permitting' women to participate; some women become aware of their own willingness to acceed to the wishes of men; and most students seem to have a hightened awareness of the supposed randomness of status in our society, and the ineffective position of those without power.

The exploration of sexism, as well as the more traditional issues which Gamson's model raises, is of course discussed in the debriefing immediately after SIMSOC and in later class meetings. And it is in the debriefing where these issues are confronted directly.

One of the few things which is agreed upon by most simulators is the importance of the post game discussion as the place where learning occurs. And it is during the debriefing that the facts of sexism are most frequently overlooked. Do we ask: what roles and attitudes did the males have? Did they differ from the roles and attitudes of the females? Did women or men have the power - or the authority? Were women or men leaders? And most crucial: Why was it this way? Who is talking most now? Who is really listened to? Why?

Research conducted by Coleman, McElroy, and Whitehurst (1973) on small group problem-solving indicates that participants' perceptions of leadership differ in single-sex and mixed-sex groups, and more importantly, that perceptions of leadership differ from objective observations of leadership. "Men were chosen as leader, both by themselves and by others, far more often than women were chosen as leader." (p. 8) However, "in single-sex groups, not only are women able to see themselves and other women as being leaders when there are no men present, but women actually tended to choose themselves or be chosen by other women at a slightly higher rate than men chose themselves or were chosen when there were no women present." (p. 9)

Further, "perception of leadership in small mixed groups appears to be subjective in that leaders are apparently chosen not on task-related ability but largely on the basis of perceived status. In conditions where there are clear status differences (e.g. in mixed groups), reliance on such ascribed criteria as 'maleness' appears to occur, while in situations of no clear status differentiation (e.g. in single-sex groups) objective criteria such as quality and quantity of interaction may assume more importance." (p. 9)

When the researchers compared perceptions of leadership with the objective criteria for leadership (number, duration, and quality of interactions) they found a statistically significant difference: women were objectively leaders in 60% of the cases; yet were perceived as leaders in only 7% of the cases. (p. 11)

Is this phenomenon of perceiving leadership through sex-colored glasses happening in the simulations and the debriefings we direct? Are our own perceptions as 'detached, interested' observers filtered through our conceptions of 'appropriateness'? Who are the decision-makers in our games? I would suggest that we carefully watch the processes by which decisions are made - perhaps extend our use of videotapes - and seriously attempt to confront the links between sex and leadership.

Boocock suggests that "games may affect attitudes, in particular the individual's attitude toward his sense of control of environment." (p. 316) If she is correct, and I believe she is, then it seems to me that we must deal with the attitudes of all our simulation participants -- male and female -- toward control of their environments. We must share with them our understandings of the sexual structures of our games, our perceptions of sexist acting in the game setting, and explore with them all the facits of the issues of life chances, leadership, decision-processes which our games reflect.

In my three plus years of gaming I have found little interest, rare discussion, and no research on these issues I have raised. Why not? What does this lack of concern say about game designers and directors? It is time to look at ourselves, our biases, our views - to see if we, through our simulation experiences - are limiting the options and perceptions of those who play - so trustingly - our games.

If there is any moral obligation on the designer or director of a simulation (and sometimes I wonder if we acknowledge any) it must be the obligation of pointing out the realities illustrated by the simulation, and their impact on the participants' views of the social world. It seems to me that a part of this obligation must be the obligation to deal with the sexism illuminated through the simulation - consciously, frequently, and seriously.

Boocock, Sarane S. An Introduction to the Sociology of Learning. Boston: Houghton Mifflin, 1972

Cohen, Richard B. "A Remote Island, for You," Simulation/Gaming/News (May, 1973), pp. 9-11.

Coleman, Marietta, David McElroy and Carol A. Whitehurst. "Sex Differences in the Perception of Leadership in Small Groups," paper presented to the Pacific Sociological Association, May, 1973.

Glandon, Nancy D. "Sexism: Rigging SIMSOC to Make the Point" Simulation/Gaming/News, Vol. 1. No. 8 (September, 1973), pp. 1, 5.

Schneider, Joseph W. and Sally L. Hacker. "Sex Role Imagery and Use of the Generic 'Man' in Introductory Texts: A Case in the Sociology of Sociology," The American Sociologist, Vol. 8 No. 1 (February, 1973), pp. 12-18.

Simulations

Ghetto, Western Publishing Company, New York, 1969.

High School Game, developed at Johns Hopkins, was demonstrated by Constance Seidner at the National Gaming Council Symposium, 1972.

Marriage Game: A Simulation of Marital Decision Making, Cathy Greenblat, Peter Stein, and Norman Washburne, Random House, 1971.

SimSoc: Simulated Society, William Gamson. New York: The Free Press, 1972 (second edition).

ADVOCACY - A COMMUNITY PLANNING GAME FOR THE RANKING OF SCHOOL SYSTEM GOALS AND TRAINING NEEDS

J. Robert Hanson, Manager
Educational Systems Division
Scientific Management Associates
R130 Nicholson Road
Gloucester, N. J. 08030

I. Introduction

The "Advocacy" planning game is one more step in a growing trend to include the public in decision-making areas formerly ruled by specialists. Recent examples of the public's entry into social policy decision-making includes consumer protection (the meat boycott), public safety (Nader's Raiders, et al) and legislative issues ("Common Cause", taxpayers associations, etc.).

"Advocacy" also represents a fundamental shift in public policy determination in that the total community--taxpayers, parents, staff and students--are involved in assessing both the needs of young people and determining the goals the schools are to service.

But why a planning game? There are three reasons:

1. there must be an agreed upon mechanism for determining school system priorities since resources do not allow all concerns to be treated at the same time;

2. there must be a way to include in the decision-making process all the people affected by the educational system--particularly students and the community that finances the schools;

3. there needs to be a way to include in the school system's thinking the educational goals identified by the State Department of Education, and approved by the State Board.

The result of playing "Advocacy", or nearly any type of educational planning game, is that 1) the school system will have prioritized goals and 2) an agreed upon procedure for using its resources in a way that a) focuses on the client--the student, and b) represents the involvement of the total educational community: parents, teachers, school administrators, students and the larger community.

II. A planning game

"Advocacy" is an interaction game. Unlike board games ("Monopoly", chess, etc.) or simulation games (computer or data bank-assisted), "Advocacy" is built around people interacting with one another and then recording their actions on a board, rather than having the board (via die, spinners, etc.) determine their actions for them.

The name of the game comes from the fact that participants are asked to consider the students' needs from a position other than, possibly, the one they may be most familiar with. The game is not, however, to be confused with role-playing. In role-playing participants are asked to demonstrate pre-determined behaviors, often purposely hidden from the other participants, for purposes generally resulting in a conflict situation which can then be resolved. In "Advocacy" the assumption is made that conflict already exists since there are no community-approved goals or procedures for the operation of most school systems, and that the acknowledged lack of such approved procedures results in conflict through the public's non-involvement or misunderstanding. "Conflict" is a constant in all human relationships, and when addressed constructively can be seized as an opportunity for resolution and progress. Therefore, the game assumes disagreement even to the point of agreeing to disagree, but disagreeing within the rules of the game, i.e., that the democratically achieved final ranking of needs and goals will be personally "owned" by the game's participants.

Participants are assigned to constituency tables advocating educational needs resulting from the community-wide needs assessment process. For example, tables would be identified as "teachers", "administrators", "students", "Board members", etc. Those assigned to each table, however, would constitute a mix of representatives from all the various constituencies in order that a balanced representation of personnel would be present at each table. This mixed representation is critical if the community's participation is to be taken seriously in policy-making, and more particularly if the school system is to become student or client-centered. The mixing of constituency representatives, therefore, provides for: 1) increased interaction between members of the educational process, 2) a method for resolving conflict, and 3) possibly a more objective analysis of training needs for particular constituency groups.

"Advocacy" is an educational as well as a planning game. The game's several purposes also include educating the community toward more pertinent solutions to young people's needs, and away from some of the authoritarian attitudes their own education may have fostered in them.

III. Game Organization

As gamers arrive they register, receive a name tag, and are assigned to a constituency table. There are five constituencies in most school systems: 1) students; 2) Board members; 3) teachers and

and support staff; 4) administrative staff (including clerical and custodial support personnel); and 5) the community.

Constituencies represent both the groups from which educational needs have been solicited and those who will generally desire additional training in light of the new or revised educational priorities resulting from the planning game.

A central factor in "Advocacy" is the recognition that "new occasions teach new duties", or more specifically that with the clarification of school system priorities the roles of all personnel change. These approved changes then inevitably require the development of new skills, and thus the total educational community--the five constituencies--act in concert to determine what training priorities need attention in order to implement those agreed upon changes. For example, if a high ranked goal was "...to more effectively prepare senior high school students for the selection of a career..." then it would probably be necessary to train guidance counsellors, teachers and selected community representatives in effective methods of re-orienting the curriculum, finding out-of-school opportunities for site visitations, and bringing guidance personnel up-to-date on the entry requirements for many different types of jobs. Or, if the game results in a high ranked need to "...individualize instruction for each student..." then teachers, administrative staff and Board members would need training in curriculum design, new patterns for supervision, and the introduction of programmed budgeting, etc.

In short, it is unrealistic to expect prioritized needs responsive to vastly accelerated social change to be effectively implemented without taking seriously the need for assisting all levels of personnel in obtaining new skills and attitudes.

IV. Playing the Game

The game is divided into an introduction and three rounds.

The introduction consists of a rapid overview of the needs collection process, and often there is some type of audio-visual presentation to explain the rules of the game.

Round I Ranking of Product Needs/Goals (white cards)

The game facilitator at each table introduces the goals resulting from the community-wide needs collection process. These are goals which are focused on student achievement and are the "outcomes" or "products" of the school system. These product needs have been converted to cards with one need or goal on each card. Each goal also has a number weighting, and, of course, the name of the constituency for which outcomes-products are being recommended.

The group then begins a discussion process resulting in the ranking of each individual goal. This ranking is accomplished by:

1) the facilitator presenting the goal and answering questions
2) the group discussing and ranking the goal by placing it on a numbered mat (mats are numbered from +5 to -5 -- "extremely important" is a +5, "moderately important" is a +3, etc.)

The group may change its collective mind as often as it wishes during the allotted time period. The facilitator will be responsible for keeping his group on schedule in order that all product needs will be "matted" by the end of the round.

At the end of Round I, the matted needs are collected by messengers and are delivered to the game manager's table. Here the needs are tabulated and are immediately fed back to the tables by closed circuit TV monitors. Additionally, the totals are posted on a chalkboard.

During the first intermission, gamers will be able to compare how their high ranked goals fared in comparison with the other tables.

Round II Process Needs/Goals (yellow cards)

The second round follows a similar process with the cards being matted after explanation and discussion. In the second round, however, the group will be prioritizing proposed training procedures for the outcome goals that ranked highest in Round I.

It is the facilitator's responsibility to see that only those process goals are ranked that are responsive to goals that survived Round I.

Again, at the conclusion of Round II, the matted cards are collected, tabulated and fed back to the tables on the TV monitors.

Round III Final Ranking of Product and Process Goals

In the last round the product and process goals surviving the first two rounds will be re-ordered. In some instances there may be high-ranked product goals without correspondent process goals. The lack of a process counterpart does not reduce the product goal's value.

The facilitator will introduce both cards in a set (one product-white, and one process-yellow) for matting at the same time.

At three points during Round III (every 15 minutes) the game manager will announce the changing scores for the sets surviving Round II. In this way each table may be kept abreast of what is happening at all the other tables.

At any time during the game, participants may send messages via "runners" to other tables requesting support for particular goals. The responding table will then "negotiate" some form of exchange or trade for their particular favorites, i.e., advocating the approval of certain outcomes and their counterpart training components.

Additionally, new goals may be introduced by a table (a constituency) and proposed before the entire group via the public address system. Also, a goal rejected in Round I may be recalled, or rewritten, and proposed for reconsideration through the public address system and/or via group to group negotiation.

Any gamer may go to the microphone at any time to speak for 90 seconds advocating a particular product or process goal.

Spaces are reserved in the room for small groups to caucus during each round, and between rounds. It is important, however, that not more than two group members be absent from their respective tables at a given time. The absence of more than two members effectively restricts the remaining players from matting the remaining goals.

At the end of Round III the matched sets of ranked products/processes are submitted to the game manager, are tabulated, and as a result of a total number of points secured for each product goal are placed in a ranked order from highest to lowest.

This listing then becomes the school system's developmental blueprint for the following year. Needs ending up in a position too low for inclusion in Year I may then be scheduled for Year II, and so on.

School systems are encouraged to replay the game at two year intervals in order to sustain community interest and support and to assist the district in keeping current on student needs.

At no point does the ordered ranking of goals foreclose administrative responses to crises. Hopefully, a well-planned and executed planning procedure will reduce the number of emergencies that arise.

VI. Decoding the Advocacy Cards

Reading the cards is easy. The cards have been coded with the layman in mind.

In the upper left-hand corner is an Arabic number which indicates the importance the constituency which submitted the card placed on the goal. The Roman numeral is the number of the submitting constituency; hence, in our sample shown below this is the second highest need submitted by Constituency Seven. In the upper right hand corner is a letter which indicates how important the need was interpreted to be by all the constituencies submitting needs in the assessment process. This sample card's needs were in Category "A" representing the highest level of need, i.e., it occurred the most often among needs submitted by all the constitutuencies.

The number appearing next to the letter indicates the need's correspondence with the State's product and process goals. For example, if a 10 point value appears there is a complete correspondence (5--partial and 3 or less a minimal correspondence) between the need and the State's approved goal structure.

The lower left-hand corner contains either an "N" or a "T". This means the goal is new to the operation of the school system, or that the program now exists (T) but is in need of upgrading.

2:VII	A-10
Training of all school personnel in loving their neighbor, protecting their environment, expanding consciousness and cooperating with one another.	
$10/person per instructional hour for 100 people for 10 hours for a total of $10,000	
N	June 1973

The costs of training needs are estimates based on current expenses. The time designation is an estimate of when the need might be implemented if approved. The card also specifies how many need to be trained, and approximately how long the training will last for a total dollar amount.

General Notes

The figures for costs and numbers of people involved can be increased or decreased based upon the group's assessment of the goal's importance.

Groups will not be given the names of the constituencies submitting particular needs in order that each goal be examined and discussed on its own merit.

The number and letter coding is for the gamer's guidance only. Gamers are to make up their own minds about the importance of each need.

LEARNING TOOLS TO RESEARCH INSTRUMENTS: A RESEARCH PACKAGE FOR STARPOWER

Richard L. Dukes
University of Colorado at Colorado Springs
Colorado Springs, Colorado 80907

Introduction

Many of the most widely used simulation games have been designed primarily as learning tools. If social research is to take advantage of the strong points of these simulation games for testing social theories, then procedures must be developed for converting simulation games into products which allow the gathering of data for testing theories while still preserving the playability of the games. The use of games in social research does not necessarily preclude their use as learning tools, as in many cases revised games can serve both learning and social research purposes adequately.

This paper will present modifications for the simulation game, Starpower[1] (Shirts, 1969). The modifications are intended to provide examples of how simulation games may be modified for use in social research. The entire "package" of modifications presented here allows the gathering of data on approximately 80 variables which can be used to test social theory.[2] The revisions reported in this paper have been used in over forty plays of Starpower and do not seem to significantly alter the playability of the game. Revisions should be taken only as suggestions which should be modified freely in order to fit particular combinations of research and learning needs.

Game Materials

All game materials can be carried in a small case. Description of the case and its contents provides a convenient way of describing game materials and revisions of the game.

----

1 It is assumed that the reader has at least some familiarity with the original version of the game. If this is not the case, the reader should see the "Directors Instructions" for Starpower.

2 Variables from the package have been used to test a theoretical model derived from Ralf Dahrendorf's Class and Class Conflict in Industrial Society (1959). Results of the test may be found in Dukes (1973).

Game rules and standardized instructions to players can be written on the inside of the lid of the case for reference during administration of the game. The use of standardized instructions to players helps to increase comparability between plays of the game and is highly recommended. It is also recommended that the game rules be written where players can see them. Not only do written rules seem to help the players comprehend the game more clearly, but during the rule change portion of Starpower, the upper class members can be required to formally state any rule changes by erasing the original rules and writing new ones. In this way, rule changes can be recorded accurately by observers. The most convenient place on which to write the rules seems to be the same chalkboard on which players' scores are tallied.

Distribution of Game Materials to Players

When random assignment of players to the social classes of the game is dictated by the research design, a quick method of assignment of players to classes and distribution of game materials is necessary. The use of business envelopes of various sizes to hold playing chips, identification tags, and Players' Logs can provide such a method. Business envelopes come in a series of sizes. The 9½ inch size can be used for the upper class, and the 9 inch size can be used for the lower class and so on. While players do not seem to notice the differences in the sizes of these envelopes, game administrators can tell at a glance which type of distribution of playing chips is contained in any envelope. The envelopes then can be placed in the case in a random sequence. Since Starpower is usually played with the same number of players in each social class, the envelopes can be sequenced in groups of twelve, for example, with dividers between groups. Within each group of twelve envelopes there would be the same number of envelopes for each social class. Envelopes can be passed out of the case (in order) to players in blocks of twelve and still insure random assignment as well as quick distribution. When there are only players left unassigned who form a block of less than twelve, equal numbers of envelopes for each social class can be selected from the next block of twelve envelopes in the case. This small number of envelopes can be quickly shuffled into random order and distributed to the remaining players. In classroom situations, frequently players arrive just after assignment of players to groups has taken place. Quick identification of the contents of an envelope from the outside allows assignment of individual players to one of the groups without unbalancing the sizes of the groups.

Identification Tags

In order to ease observation of play of the game, the square, circular, or triangular-shaped group identification tags can be provided with unique symbols, so that the observers can identify individuals during the game and record their behavior. Circle tags can be assigned letters of the alphabet, square tags can be assigned numbers and so forth. Partially removing players' anonymities in this way may lessen tendencies toward collective behavior, however the impact of uniquely identifying players is probably small, particularly in situations where players may already know each other anyway. This procedure also simplifies the game due to the fact that game administrators do not need to know the initials of the players, and there is no confusion due to two players having the same initials. When there is inter-group mobility players exchange these tags as in the original version of the game.

Players' Logs

A system of gathering information about play of the game during trading rounds is presented below. In this system, players keep track of the identification numbers or letters of the players with whom they trade as well as the colors of the chips which were exchanged.[3] In this way the researcher can keep a sequential account of players' chips, scores, trading patterns, bonus points and inter-group mobility. Players fill in the information as they trade. This procedure does not seem to interfere with the normal tempo of the game. One scoring page is kept for each trading round of the game. These scoring pages are alternated with pages of questionnaire and rating scale items which the players fill out between rounds of the game while the administrators are preparing for the next round of play. The items are designed to measure players' attitudes towards other players as well as their observations of play. Questions are presented in an increasing number after each round. Most of the questions are asked more than once so that changes in attitudes or ratings of play can be measured. Questions which might suggest strategies to players are asked only after the game is over. Coefficients of reliability using the test-retest method range from .82 to .98 for these items.

----

3 During pre-testing of the revisions, another scoring system was tested. Chips were assigned unique identities. Players recorded the identities of their chips after each trade. This procedure proved to be too tedious for players and was replaced with the present system.

Group Bonus Procedures

The distribution of group bonus chips to each social class in small boxes is a procedure which avoids the bias of giving these chips directly to a particular member of each grouping. The boxes containing the three group bonus chips can be placed in the center of each group. Players then take it upon themselves to pick-up and distribute the chips. If the chips are given to a player by the game administrator, this player is placed in a position of authority by the administrator and usually receives at least one of these chips. The use of the boxes also allows observers to record the identification number or letter of the person who subsequently picks up the chips. Players are told that the bonus chips are not considered to have been allocated until the chips have been given physically to the receiving players. When the bonus round is over, the game administrator picks up the boxes whether there are any unallocated chips in them or not.

Timed Rounds

The use of a timer with an audible alarm can be used to accurately limit the time of each trading round and bonus round in the game. The timer insures comparability in the length of the rounds, and it provides a non-arbitrary decision maker for ending each round. When the alarm sounds, the round is over.

Preparing for Another Round of the Game

After scores have been computed and players have exchanged identification tags and seats (but not scoresheets or chips), the game administrator may choose to collect and redistribute all the chips as directed in the Starpower Instructor's Manual, or he may let the players continue to play with the chips they have. While this latter procedure may tend to lessen the impetus to trade in subsequent rounds, if bonuses for the number of trades are used, (see below) this tendency rarely becomes a problem. The procedure offers quicker progression of the game, especially with large numbers of players.

Checking for Errors and Filling-in Missing Information

At the end of the game, chips, identification tags, and Players' Logs are put back into the envelopes and returned to the game administrators. This procedure allows later checking of actual chips against reported score as well as the checking of tag identification numbers or letters against the reported group affiliation. As envelopes are unpacked, the colors of the chips in the envelope can be written at the bottom of the last score sheet for later coding and checking. Once the game materials are readied for another play, missing data in the log is sometimes impossible to replace, so careful unpacking and checking of the envelopes after each play is advantageous. Sometimes information about play which is missing from one log can be found by checking the scoresheets of other players in the game, as the information concerning trading of chips or tags between two players is recorded by each. During the design phases of scoresheet construction, such comparisons can provide information on the accuracy with which players can use the scoresheets. College-age players used the scoresheets with a 98% accuracy rate during pre-testing of this instrument.

Tape Recording Play of the Game

A small cassette tape recorder can easily be carried with the other game materials. A high-quality machine with an internal microphone can record inter-group conversation in a rather large room without ever being taken from the case containing the other game materials. Tape recording seems to be most useful during the portion of the game when the rules are changed. The benefits of recording the <u>entire</u> game should be weighed against the time consuming task of listening to hours of tape. For use with <u>Starpower</u>, tape recorders seem to work best during bonus and rule change portions of the game as back-up devices which are used in conjunction with observer category systems and long-hand notes. The usual cautions concerning unobtrusive tape recording and player privacy should be observed.

Observer Rating

Several methods of observer rating have been combined to provide a flexible method of rating game interaction. Many different types of systems were tried, but the method which seemed to work the best is presented here. Also, rather than rating complete games, the rating of group bonus rounds (intragroup interaction) and portions of the game in which the rules are changed (inter-group interaction) seemed to provide the most important information on interaction without hurting the playability of the game. During the bonus rounds, one observer (usually game administrators can do these observations) sits in or near each group and records the tag identification number or letter of players who interact during the three-minute session. These observations are very easy to rate and yield the amount of interaction initiated by each player. If it is important to know to whom the interaction was directed or the type of interaction during this portion of the game, then the simplified Bales (1950/1970) method of scoring (described below) can be used at this time *as well as* during later portions of the game. During the portion of the game in which the rules are changed, an observer sitting in each of the groups notes the tag number and classifies the interaction of each player in the group which is directed to players in the *other* groups. The coding scheme is a condensed version of the Bales technique. There are four codes: "$\smile$" (smile) for positive reactions; "." (period) for statements or attempted answers; "?" (question mark) for questions; "$\frown$" (frown) for negative reactions. The coding scheme preserves much of the original system, but since each code has a high intuitive meaning, it is simpler to use. Observers can remember the four simple codes, so an ordinary stenographer's notebook can be used rather than the printed forms commonly used with the Bales technique. The notebook format provides a very flexible procedure for mixing codes with long hand notes on any collective behavior which may occur during this part of the game. Using one code or note per horizontal line of the notebook keeps the entries in proper time order. Long-hand note taking begins when a player leaves his seat; the observer for the group in which the player was seated writes down the activity of that player. If the player changes a rule on the chalkboard, the observer copies *ver batim* what the player writes on the board. After the game, observers code all rule changes onto a standardized code sheet, which when completed for a number of plays, allows comparison of rule changes across the game plays.

Different Numbers of Social Classes

The game rules for use with the present version of this package create only two social classes instead of the original three. The middle class has been eliminated. The number of classes was reduced since the theory to be tested in the research for which this package was designed, was conceptualized in terms of two social classes. Added advantages of using only two social classes include 1) the necessity of having only two observers and 2) decreasing the number of relationships between groups. For groups A, B the only inter-relationship is A-B, but for groups A,B,C there are three inter-relationships: A-B, A-C, and B-C.

The elimination of the middle class may not have much overall affect on the amount of conflict in the game over many plays, since sometimes a middle class acts as a buffer between the upper and lower class, thus lessening the conflict. However, in other cases the middle class may form a coalition with one of the other classes (usually the lower class) resulting in increased conflict. The question concerning the amount of conflict, of course, can be answered more accurately in future research. At this time, however, no specific number of classes seems to be sacred, and decisions regarding the number of classes to incorporate into game rules should be based upon theoretical and methodological considerations.

Creating Different Types of Simulated Social Systems

One of the advantages of using simulation games for testing social theories is that these games can be modified easily to create social systems which are different from each other _only_ along _specified_ dimensions. Researchers can then use the "type of social system" as a treatment of an experimental design to which players or groups of players can be randomly assigned. Below are described the changes in the original rules of _Starpower_ which can be used to create an open (or class type) social system and a closed (or caste-type) social system. Since the original version of the game is primarily a closed social system, the rule changes focus on the opening up of class lines through the use of bonuses for trading. In the open social system plays, a bonus of 25 points is given to each player each time a trade is consummated. In the closed social system plays a bonus of one point is given to each player each time a trade is completed.

In the closed system _resources_ have more of a fixed value which does not increase when resources are exchanged. In the open system resources are more interactive in that they increase in value when they are traded. _Exchange_ in the closed system is more zero-sum, since except for the bonuses for attaining chips of the same color (which is quickly used up when the chips are not redistributed after each round) one player must win in each trade, and one must lose. In the open social system, exchange is less zero-sum, as the 25 point bonus per player for each trade serves to offset the point differences between the chips of unlike colors which must be traded by the players. It should also be noted that points concentrated in chip values can always be lost in subsequent trades, while points concentrated primarily in "trade bonuses" cannot be so easily lost. In this way, exchange is more risky in the closed system than in the open system. Perhaps the most important difference between the two systems is the basis of status and mobility. In each system the distribution of playing chips is the same, however in the closed system the point spread of 25-50 points between the classes is almost impossible to overcome through trading unless an upper class member makes a blunder. Therefore, as in the original version of the game, the social system is essentially a caste system in which unchanging status is ascribed before the first round of play begins. In the open class system the point spread between the classes can be overcome by lower class members who are able to make approximately two more trades during a round than any member of the upper class. Since upper class status in the open system is more achieved, there is a greater chance for lower class members to become upwardly mobile through their own trading activity. In the third round of the game, the upper class members are given the authority by the game director to change the rules of the game. In the closed system this authority is more likely to be concentrated in an ascribed, monolithic group due to the characteristics of resources, exchange, status/mobility discussed above. In the open social system authority is more likely to be concentrated in a group in which players have gained or maintained their status through achievement. In fact, quite a few of these players are likely to have experienced several group memberships during play.

Adequate Samples

Since Starpower may produce many different outcomes such as revolution, equilibrium, apathy, etc., the sample should include a number of game plays which is high enough that there may be confidence that the range of outcomes in the sample represents the distribution of the outcomes which the game can generate with a given population of players. Especially if the researcher is attempting to analyze individual behavior, there may be a temptation on his part to stop sampling when enough individuals have played the game to enable him to undertake statistical analysis. If this sample is based on just a few plays of the game, results may be heavily biased.

Conclusion

Revisions presented in this package should be taken only as suggestions, not dictums. The original instructor's manual for

Starpower was written in a manner which invited manipulation of the game rules and procedures. It is hoped that this package will invite further manipulation of the game and improvements in the package.

REFERENCES

Bales, R.
(1970) Personality and Interpersonal Behavior. New York: Hoult, Rinehart, and Winston.

Bales, R.
(1950) Interaction Process Analysis. Cambridge, Massachusetts: Addison-Wesley.

Dahrendorf, R.
(1959) Class and Class Conflict in Industrial Society. Stanford, California: Stanford University Press.

Dukes, R.
(1973) "Organization, Conflict, and Change: A Test of a Multivariate Model Within Two Types of Simulated Social Systems." Unpublished Doctoral Dissertation, Department of Sociology, University of Southern California.

Shirts, R.
(1969) Starpower. La Jolla, California: Simile II.

A PEDAGOGICAL SCHEMA FOR THE DEVELOPMENT AND USE OF COMPUTER SIMULATION TECHNOL

Dana B. Main, Robert Stout, D. W. Rajecki, Howard Eichenbaum and Trudy Villar
Department of Psychology, University of Michigan
Ann Arbor, Michigan 48104

For the past three years we have been developing and using computer data-ge erating models in teaching the undergraduate psychology elementary research design course. At the Dartmouth Conference, Main and Head reported on the first year's experience with this type of computer technology and described the general features of the first version of the experiment simulator (Main and Head, 1971). At that conference, Johnson argued for a pedagogy utilizi a computer simulation approach for teaching research design strategy (Johns 1971). He compared it to the traditional instructional laboratories and to the use of computer data banks. Since that time, Main has reported on diff ent pedagogical (Main, 1972a, Main, 1972b) and evaluational (Main, 1971) de velopments. Rajecki, et al, wrote a report detailing some of our original models (Rajecki, et al, 1972).

In meetings such as this one, in workshops, in informal faculty meetings, a in conversation, we have been asked a variety of questions ranging from en- quiries about the programming to skepticism about the value of teaching stu dents about research without generating "real" data. Some persons have bee concerned that the models generating the data may be "wrong" and, therefore may misinform the student; some fear they reflect the literature too closel and may stifle a student's questioning mind. There has been doubt that an undergraduate can really appreciate the intellectual complexity of the proc and there has been skepticism that the process is too simpleminded. There a sense in which each concern is justified if only a <u>part</u> of what we have c and envision doing is examined.

The purpose of this paper is to present the total schema which is guiding c development. Within such a structure we can point to the parts which we ar others have accomplished and with which we have had considerable experience to the parts with which we have had only recent experience, and, most impor tant, to the parts which we believe need to be developed in the near future Not only does this put our work into perspective, it may also inspire you t participate in this very exciting innovative development.

We will describe a sequence of four pedagogical modes that can engage stu- dents and be utilized by faculty who have no knowledge of computer programm This sequence can originate as early as the second semester of the freshmar year. (We strongly suspect that it could begin in high school, but we have had no such experience. Johnson has informed us of some use of this pedago in high school [Johnson, 1972]. We believe that <u>all</u> modes can be designed engage undergraduates, although more complex versions are certainly appropr ate for graduate students and professionals. A student may enter the first mode and work through all four throughout his undergraduate career. The ti spent on any particular mode or sub-sequence is dictated by the sophisticat of the student and the goals of the course utilizing this form of pedagogy.

We are not committed to any particular subject area in the behavioral scier or to any specific theoretical framework. The system we have initiated car deal with any subject matter content in the behavioral sciences.

We will describe these modes in terms of the student experience. We do this in order to emphasize the very real possibility that excellent performance by students in later modes can generate instructional materials for other students in earlier modes. We do not mean to imply that the only resources developed for the earlier modes should arise from the work of advanced undergraduates. It is reasonable and desirable that contributions be made by professional persons and graduate students. It is simply that this pedagogical schema has some interactional exchanges that are unique when compared to most educational processes.

Mode 1

In the first mode, the student receives a description of a particular problem area in the behavioral sciences. This description may be very brief and may include references to the real literature. It may be more or less extensive in supplying students with informational detail. It usually describes conflicting theories. It is meant to set the stage.

The student also receives a complete list of all possible manipulable variables and their allowable values defined by the data-generating model. In the simplest case, he is informed of a single dependent variable and its values. There may be more than one dependent variable described. He is further informed of the value of each manipulable variable that is defaulted if he chooses to ignore it. The default value is constant--that is, a particular value of the variable. It may be selected from the set of possible values by some random process.

In this mode a student designs an experiment by specifying: (1) the number of experimental groups in his design, (2) for each group the values of the manipulable variables and the names of the dependent variables in the case of more than one dependent variable, and (3) the number of subjects [within a specified range] for each group.

This information is submitted to the computer and serves as commands to a data-generating model. The student's output are values of the specified dependent variable(s) which can be plausibly interpreted as raw data. All of our data-generating models have been probabilistic; therefore, the very same design generates different values of the dependent variable.

Depending on his research goal the student generates hypotheses; designs experiments, summarizes results, and explores relationships between manipulable variables as well as functional relationships among different dependent variables. He is encouraged to report his findings in terms of support or disconfirmation of possible theories. He gets into problems of scaling and is motivated to acquire some statistical skills in order to make inferences about the underlying model generating the data.

Our first three models are in this mode. They have been utilized in the elementary psychology laboratory course each term for the past three years. This course is taken by second semester freshmen and sophomores who usually plan to major in psychology and is taught in small sections by graduate student teaching fellows. Some or all of our models have been used in undergraduate and graduate psychology statistics courses, in a course in research design for psychiatry residents, in an elementary sociology laboratory course, and in an undergraduate motivation course. The models, developed by graduate students, involve subject areas of the etiology of schizophrenia (Malin), imprinting (Rajecki) and motivation (Mueller).

Mode 2

In the second mode, the student again receives a description of a problem area. But this time he is informed of only a subset of the manipulable variables and of all, some, or none of their possible values. He may also be informed of only a subset of possible dependent variables utilized by the data-generating model. He is made aware, either initially or later, of one or more X-variables which may be contributing effect to his results. The concept of X-variables in instructional simulations was first suggested to us by Richard Johnson (Johnson, 1972) and was developed for classroom use by Cromer and Thurmond at the University of Louisville (Cromer and Thurmond, 1972). In Cromer and Thurmond's instructional models, the student is provided with a complete set of variables less one: the X-variable. Information gained from runs on the other variables may or may not lead the student to infer the X-variable. If he does, the instructor provides him with a computer command that causes the X-variable to contribute to the values in the data in subsequent runs. If the student has not correctly inferred the appropriate variable, but some other implausible or impossible alternative, the instructor may give him a command that makes no systematic contributions to subsequent data values.

Two new data-generating models developed by three of the authors of this paper are being implemented at this writing.

The Social Facilitation (SOC FAC) model developed by Rajecki involves the following problem. The <u>performance</u> of a task is generally enhanced by the presence of another person, but the <u>learning</u> of a task is usually impeded by the presence of a co-actor or observer. These effects have been found in species as divergent as insects and humans. In the initial stages of the simulation the student learns <u>how</u> these effects are obtained via Mode 1. He next learns that the effects of the presence of another are similar to the effects of generalized drive (<u>D</u> in the Hull-Spence formulation). The question is, then, why does the presence of another have such generalized drive consequences?

At this point the problem description addressed to the student ends, period. It is his obligation to specify all of the variables for the balance of the simulation. But additionally he is confronted with the task of inferring the why of the phenomenon. Why should (or would) the mere presence of another member of one's species have these effects? Is it because the task implies evaluation of performance? Does it have to do with the subjects' personality or social history? These and other questions have been raised by social psychologists whose work has appeared in the literature. Based on this literature, a large number of X-variables (à la Cromer and Thurmond) have been programmed and are available to the instructor by code name. These include (omitting details) variations of independent, dependent, and subject variables. If the student's inference matches one of the alternatives available, he will be provided with the appropriate code and can then evaluate his hypothesis. If his inference is judged to be inadequate or specious, he can be given a code name with no effect, or he can be "counselled" by the instructor.

Eichenbaum and Villars, graduate students in psychobiology, have developed a model entitled Drug Observations: Program for Experiments (DOPE). The model deals with the question of behavioral mechanisms of drug action. Four commonly known drugs may be examined in three strains of rats, in training and retention tests, and three different laboratory learning situations. All manipulable and dependent variables are given to the student, but the values of the dosage levels, time of injection, amount of reinforcement, and degree of training are infinite. The student runs the risk of drug overdose, ceiling training effects and contradictory data between different tasks, strain, and dosage levels. DOPE provides an option for additional challenge to the student. Once the "universe" of drugs has been behaviorally classified, an X-Drug may be assigned to the student. These X-Drugs include drugs similar to those four already in the model and to saline. It would be the student's task to classify the X-Drug.

In Mode 2 the student must do everything he did in Mode 1, but in addition he must operationalize concepts and particularize values of variables. He must generate hypotheses on how mechanisms work and must articulate manipulable variables. He must select from the set of possible values of the variable those he wants to explore and must justify his selection or particularization through logical argument supported by results from his simulated experiments.

These last two data-generating models encourage a stepwise systematic strategy. They both have more than one dependent variable. SOC FAC encourages the operationalizing of concepts across species. DOPE has some interesting inverted U-shaped functions that will encourage multivalent versus bivalent designs.

We have had extensive experience with Mode 1 and some limited experience with Mode 2. Before describing the next two modes yet to be developed for general use by undergraduates, we would like to describe the Michigan Experimental Simulation Supervisor program developed by Robert Stout, who stoutly and self-confidently uses the acronym MESS while Main, doggedly and perhaps too self-consciously, calls it EXPER SIM.

From this description we hope to convey the large set of possible data-generating models that can be constructed with this software for Modes 1 and 2 and its potential use in later modes.

Supervisor Program

The primary function of the simulation supervisor is to serve as an interface between students and models of behavior; it serves as an indirect channel of communication between the creator of a simulation model and those who explore that model. In order for it to perform its job in the most effective manner possible, the supervisor has been designed to be maximally unobtrusive; it requires little special knowledge and skill from either the student or the simulation designer, although, of course, the student's task is by far the easier. Though simple to use, it is a flexible, powerful system; it is possible for a student to specify an experiment involving a five-way factorial design with only five lines of input to EXPER SIM. Students can design factorial experiments involving complete or incomplete, balanced or unbalanced designs, or even split-plot (within-subjects) designs or covariance designs. There is no general type of experimental design it is not possible to do.

From the point of view of the simulation designer there are also few restrictions on what can be done. Although the system is primarily oriented toward models which produce a numeric output, it would be possible to implement a model whose output was, say, English sentences. Models may be static or dynamic univariate or multivariate. The current software, which can easily be modified to fit different size requirements, can handle up to thirty-six independent variables and six dependent or concomitant variables. Implementing a model involves writing a FORTRAN subroutine which embodies the model, and preparing for the supervisor program a data deck which specifies the names of the simulation variables and their allowable abbreviations, legal values, default values and other program parameters. The amount of programming necessary to produce a model is not usually large; the model subroutines for the currently available simulations are between one hundred and two hundred FORTRAN statements long, including extensive comments. There is a subroutine library containing random number generators for a variety of univariate and multivariate distributions, as well as numerical integration routines.

Although all the models implemented to date generate data de novo each time they are called, this situation is primarily a matter of convenience; it would be a simple matter to write a "model" subroutine which would sample from a bank of, say, survey or personality data, instead of using an algorithm to generate artificial data. It makes no difference, of course, what content area is being simulated; it is as easy to simulate experiments in economics or pharmacology as in psychology.

While EXPER SIM makes the programming part of creating a simulation relatively easy, it should not be supposed that bringing a good simulation into being is a trivial task. If a model is to be realistic it must include all of the quirks interactions, and variability of real data, and devising a simulation containing any reasonable number of variables is a task that can strain any scientist's knowledge and imagination.

Mode 3

In the third mode, we envision undergraduates modifying algorithms of models they have been extensively exploring during the first two modes, developing algorithms of data-generating models in different subject areas, and developing models that generate conflicting data or different models that generate similar data. We would like to design the instructional environment and the computer technology such that undergraduates could engage in an educational experience of the kind the graduate students who worked on our past models have experienced. As in Mode 2, the student would have to operationalize variables and select or particularize values of these variables. But rather than exploring relationships and fitting simulated data to hypothetical theories, the student must specify these relationships, generate the algorithm, and explore via Mode 1 the consequences of his modelling decisions. He may add or modify variables as in Mode 2. But the important component of this mode is that the student learns how a behavioral mechanism may work by attempting to build a mechanism that generates data similar to what is known about that mechanism. It is our hunch that some students could begin to explore Mode 3 even at the end of our elementary research design course. Certainly this is an activity in which many advanced undergraduates could engage. If the student has programming skills, excellent models can be developed for instructional purposes--such as PAVCO-Pavlovian Conditioning that Richard Nussloch developed as an undergraduate at MacAlister College (Mink and Nussloch, 1971).

At the present time, however, the vast majority of undergraduates in the behavioral sciences do not program. Although they could be challenged to generate at least first approximations of their models, they cannot place them onto the computer for exploratory and modification purposes without the assistance of a programmer. With the large number of undergraduates at the University of Michigan, the bottleneck created by the necessity of a programmer has been too great for us to attempt to develop Mode 3 on any large scale. What is needed is an interactive program with sufficient flexibility that enables undergraduates without programming knowledge to place their models onto the general program for purposes of their own exploration and possibly for exploration by other students participating in earlier modes.

Mode 4

The final mode is one that links the students' simulation activities with the "real world". Those of us enthusiastic about computer simulation pedagogy often fail to convey that the purpose of all of this is to help students develop strategies for understanding the "world outside" (whatever that might be interpreted to be). We envision laboratory courses in which a student having explored his own model in Mode 3 or that of someone else's in Modes 1 and 2, compares simulated data to that which he has collected in real laboratory experiments. The real data that he and his classmates collect could be stored in a data bank and compared to that generated by a model.

At the University of Michigan, Flint, Raphelson (Raphelson, 1971) teaches his motivation course using a data bank with data generated by his students over several terms and by our Mode 1 motivation simulation. Cromer and Thurmond have used laboratory data generated by students in conjunction with data-generating models (Cromer and Thurmond, 1972). Rajecki has piloted this mode with the SOC FAC model and student generated data this past term.

The Mode 4 is limited by the kinds of data a student can feasibly collect or by the kind that can be collected in data banks, but it is in this mode that he can develop descriptive and predictative skills in terms of real world phenomena.

In summary, we have presented four pedagogical modes that utilize computer simulation techniques. We have described where we have been, where we are now, and where we hope to be. It is an exciting adventure. Why not join us?

REFERENCES

Cromer, A. O., and Thurmond, J. B. Toward the optimal use of computer simulations in teaching scientific research strategy. Proceedings of the 1972 Conference on Computers in Undergraduate Curricula, June 1972.

Johnson, R. DATACALL. A computer-based simulation game for teaching strategy in scientific research. Proceedings of the Second Annual Conference on Computers in the Undergraduate Curricula, June 1971.

Johnson, R. Personal communication, 1972.

Main, D. B. and Head, S. Computer simulations in the elementary psychology laboratory. Proceedings of Second Conference on Computers in the Undergraduate Curricula, Dartmouth College, June 1971.

Main, D. B. A computer simulation approach for teaching experimental design. Presented to the American Psychological Association, Washington, D. C., September 1971.

Main, D. B. Toward a future-oriented curriculum. American Psychologist, 27, 1972a, 245-248.

Main, D. B. The laboratory class as a simulated scientific community. Presented to the National Gaming Council, Baltimore, Maryland, October, 1972.

Mink, W. and Nussloch, R. PAVCO: A computer simulation on Pavlovian conditioning. Presented to the American Psychological Association, Washington, D. C., September 1971.

Rajecki, D. W., Malin, D., and Mueller, S. EXPER SIM: Computer simulations for teaching elementary research design in psychology. Report from Center for Research on Learning and Teaching, University of Michigan, February 1972.

Raphelson, A. C. Personal communication, 1972.

EDUCATION AND TRAINING FOR CONTEMPORARY URBAN PLANNING SYSTEMS:

THE IMPACT OF INTERACTIVE SIMULATION.

MAY 1973

by:

ROBERT M. SARLY, B.Arch.,M.Sc.Arch. & T.P.,

Executive Director, R.A.D.I.U.S. - Research Analysis and Design in Urban Systems.
Lecturer, Department of Social and Environmental Planning, Polytechnic of Central London.
Research Fellow, School of Environmental Studies, University College London.

ABSTRACT

Current planning education and training programmes lack a full sense of realism. They are deficient in providing the planner with enough preparation in areas of applied decision-making under conditions of uncertainty, conflict and continual change. Interactive simulation methods can help in infusing realism by means of participation, role-playing, representational and performance methods. Three alternative programmes are proposed to extend the scope of current planning education and training, and to improve the linkage to current practice: An Introductory Linkage, A Continuing Linkage, and A Service Linkage. The objectives and potentialities of these programmes are described. Many of the required methods already exist, and many others are being developed to fill current programme needs. The interactive simulation programme at the Polytechnic of Central London is one of a growing number of successful application of this approach.

EDUCATION AND TRAINING FOR CONTEMPORARY URBAN PLANNING SYSTEMS: THE IMPACT OF INTERACTIVE SIMULATION.

1. Introduction to the Present Dilemma.

1.1 Urban planning systems pervading all aspects of contemporary urban life are not just becoming more complex in themselves, but rather they are accommodating a more sophisticated understanding of the processes and inter-relationships that comprise these systems. To the student or apprentice planner preparing to take up a position of responsibility in these systems, the critical problem is to be able to clarify and conceptualise a mass of information in relatively short time as a basis for realistic judgement and decision. This problem is often not one of insufficient data but of over-abundant data of variable quality. The "data glut" is compounded in practice by a growing dependence on the evaluative judgement, understanding and experience of few over-burdened and under qualified decision-makers. Systems of urban development, planning, management, analysis, and control each require a range of skills that are in short supply in planning practice, partially because many of our present planning education and training programmes are failing to provide them. Traditional methods and modes of instruction comprising current academic programmes no longer relate very well to the changing complex requirements of contemporary urban planning systems.(1)

1.2 Maintaining a gap between planning education and planning practice must be costly both for the individual and for society, its effects could be widespread: social and economic productivity may be retarded, individual motivation may be stifled, and effective professional judgement may be impaired, resulting in part from the inadequacies of the preparation which is given the students and trainees in the planning field. A major aspect of these inadequacies is in the sense of realism conveyed in contemporary education and training programmes. Planning skills, techniques and theories are often presented in the broadest terms but with scant regard for the crucial demands of their performance in application to the real problems of contemporary urban planning systems. Programmes for preparing planners in ways and means of analysis need to have a firm grounding in the practical constraints that performance places on the evaluation and implementation of academically generated planning systems.[2]

1.3 The representation of planning systems in a realistically generated context for demonstrating the potentialities of planning in application to real problems is taken in this paper to be the model for that planning system. The behaviour of the model over time is shown by means of a simulation, and when the simulation is a function of the interaction of two or more independent decision-makers, their performance is examined in terms of some form of interactive simulation model.[3]

2. The Case for Interactive Simulation.

2.1 The gap between academic representations of urban planning systems and the so-called "real world" itself serves some important functions, including providing the possibilities of controlled analysis and experimentation. However, it also serves to devalue the relevance of much of this analysis. Little opportunity exists in the planning laboratory for the direct application of formal educational knowledge or formal training experience to the informal problems of the real world. Yet to consider these practical problems merely on the basis of their informality, lack of intellectual rigour, difficulty of measurement, or controversiality is surely counterproductive to the basic aims of preparing planners to perform most effectively in a changing profession and under conditions of uncertainty and conflict.[4]

2.2 There are certain practical problems that are currently left almost entirely to the fortunes of chance, whim and intuition. In the framework of urban systems these problems often cover important areas of knowledge, to name a few, such as: the processes of developmental change and social succession in urban regions;

the mechanisms of community interaction and communication; the management of competing and conflicting planning interests in urban space; and the nature of government intervention in the private sector over time. These problems also cover important training areas such as: the operation of bargaining mechanisms in the property and job markets; the co-ordination of policies within and between local authorities and social groups, the effectuation of citizen rights, (e.g. landlord-tenant, employer-worker etc.) and political opportunities. There are many more.(5)

2.3 Not that all these problems areas are totally ignored in current education and training programmes; on the contrary many of them are analysed dispassionately in the objective atmosphere of formal lectures and discussions. This is a classical approach but it may leave the student with rather little with which to discern the relevance or realism of complex urban planning systems should he be confronted with having to make a responsible decision. On balance, some of the most important aspects of current programmes include: clear and objective analyses, formal and dispassionate discussion, exemplification and generalisation, and description of general conceptual forms and structures. Some of the most deficient aspects include processes of plan synthesis, both conceptual or operational synthesis; the dynamics of human interaction and value formation, the time processes (e.g. development, growth and decay), planning uncertainty, (e.g. the inadequacy of data, the ambiguity of judgement, and the difficulty of measuring effects), and analyses of self-interest (i.e. the legitimate motivation of different people and groups based upon their perceived objectives, priorities and values). Overall there is a basic need for reinforcing the generalist perceptions required of the planner in co-ordinating the specialists with whom he must work.(6) It is suggested here that if this is done, the approaches used would be likely to amount to some form of interactive simulation.

3. <u>The Essence of Interactive Simulation</u>.

3.1 There is no single type of interactive simulation any more than there is a single type of lecture, or job; but there are certain basic characteristics commonly identified with those instructional methods relating to interactive simulation. In terms of these basic characteristics, the application of interactive simulation methods may vary from the highly structured approach to the loosely structured. Some examples are discussed below.

3.2 A primary characteristic of interactive simulation is <u>participation</u> The participant initiates purposeful activity in response to a set of given conditions of which he is a part. One example of a highly structured participation simulation exercise is the programmed teaching machine. The participant responds to a given question and proceeds according to the success of his responses. A common example of the loosely structured participation simulation is an architectural design studio, in which the student/apprentice must actively simulate real buildings by drawing pictures of them and by responding to the conditions of the brief and the judgement of the design instructor.[7]

3.3 A second characteristic is <u>role-playing</u>. Several students participate in relation to one another's roles, as well as to their own. The theatre is a popular form of highly structured role-playing simulation and "good theatre" may be quite a good source for understanding the complexities of human nature. Most professional actors take roles that are fairly well defined, leaving the scenario of role interactions with little uncertainty except to the audience as to the final outcome. In other circumstances such determinacy is unrealistic and role interaction simulations ,ay be more loosely structured, as in the many role-interaction games used to train business managers, personnel directors, industrial relations representatives, and government planners. In fact, role-playing interactive simulations are relevant to any bureaucratic position where the understanding of human relations is of prime importance.[8]

3.4 A third characteristic is representativeness. A simulation is a replication of change; it is a model that represents a process of change that occurs in reality by selecting those aspects of the process that are relevant to the objectives of the study at hand, and by simplifying the rest. Highly structured representative simulations may take the form of computer-operated or computer-assisted models of reality, since these can be readily shown to represent certain parts of real urban aystems. The representation takes place as a result of both a machine-manipulated set of procedures and a man-manipulated set of objectives. These methods are most applicable for projecting current conditions or for studying current patterns of behaviour. Loosely structured representative simulations may be used to illustrate the general principles of urban systems and behaviour such as the population explosion or the evolution of slum areas.(9)

3.5 A fourth characteristic is performance, the course of activity following the simulation is measured or monitored in terms of the activity of each individual participant and the consequences of his interaction with the simulated urban system. The highly structured performance simulations are used to pursue such questions as the efficiency of a man at a desk doing a given job in a bureaucratic context; or the cash flows of a new town development programme with criteria for evaluation economic viability. On the other hand a loosely structured performance simulation might look more at the behaviour of the participant while engaged in the simulation, such as in the examination of informal information requirements by local authority councillors many programme policies for the next 5-year period.(10)

3.6 In short, the essence of interactive simulation is that it instructs in areas of knowledge and experience that bridge theory and practice in urban systems at a level less formal than the prepared seminar or programmed lecture and more formal than a chance, whim or intuition. In a highly inter-connected urban society the social cost of sub-optimal planning decisions can be enormous, but it would be a needless waste if it could be reduced even slightly by improving the quality of those planning decisions by more realistic preparation of planners for their real professional roles.

4. A Practical Programme for Interactive Simulation.

4.1 The primary objectives of a practical programme of interactive simulation which supplements an existing course in urban planning systems should be closely related to fulfilling practical requirements of the programme. These objectives can be used to measure the utility and the effectiveness of the interaction simulation programme.

4.2 As mentioned above, three deficiencies in current education and training programmes particularly amenable to methods of interactive simulation are:

4.2.1 Assessing the effects of time on the processes of development, growth and decay.

4.2.2 Monitoring aspects of uncertainty with respect to data, value judgements, and consequent effects.

4.2.3 Accommodating the legitimacy of differing self-interests and the motivational behaviour of different urban groups.

4.3 An instruction programme in the field of urban systems that could be improved in any of the aspects above might well consider some of the methods of interactive simulation. This could take several alternative forms.

Alternative 1: INITIATING LINKAGE

I Course/Training Unit

Alternative 2: CONTINUING LINKAGE

Course/Training Unit II

Alternative 3: SERVICING LINKAGE

Course/Training Unit

III

4.3.1 The Initiating Linkage.

At the very beginning of a course of instruction an intensive block of interactive simulation activity would serve the following purposes:

A. It presents a broad brush preview of the entire course showing how the pieces fit together and the order in which they are to be taken.

B. It confronts the participant with the problems he is expected to be able to solve upon completion of the course.

C. It puts the subject of the course into the broader context relating to other areas of knowledge and experience the participant may wish to draw upon in the course.

D. It helps to break down the natural inhibitions of the participant to his colleagues and to build a sense of group identity which serves to reinforce learning.

E. It helps to break down the polarisation between participant and instructor and helps to encourage learning at various levels simultaneously.

F. It stimulates interest and enthusiasm for the subject and provides insight into the nature of responsible decision making in the course area.

4.3.2 The continuing linkage.

To place the block of interactive simulation activity at the end of the course unit would shift the emphasis of the programme toward aspects of evaluation and implementation with the following purposes:

A. It re-integrates the more difficult aspects in the course showing their relevance and application.

B. It demonstrates the application of course-taught materials to situations in which the effectiveness of those materials can be seen and evaluated.

C. It tests the general ideas developed in the course by implementation in given situations.

D. It helps to differentiate the function of analysis in the course from that of judgement and it elucidates the relevant processes of decision-making.

E. It gives preliminary experience in dealing with the course matter in a context of reality, and it allows the participant to practice his newly acquired skills and rehearse his broadened understanding of the urban system and to monitor his performance.

4.3.3 The servicing linkage.

Alternatively interactive simulation activity may be spread throughout a course unit so that, at each staging point within the formal course, reference could be made to its counterparts in reality by means of the simulation activity. Co-ordination is paramount in this kind of linkage, one variation of which is the interactive simulation course unit, in which the subject of the course is the interactive simulation method itself, with the following purposes:

A. To demonstrate the relevance of interactive simulation methods for urban systems analysis.

B. To attune the participant to the mechanism of interactive simulation and to its potentialities for adaptation to different types of application.

C. To provide the opportunity to devise and test interactive simulation models and exercises with respect to a given set of instructional objectives.

D. To strengthen the interactive aspect of urban systems and to provide the opportunity to exercise the course materials in the process of their development.

5. Two Examples of Interactive Simulation Exercises.

5.1 The M.A.R.R.I.A.G.E. Game.

5.1.1 Marriage and Related Roles in a Gaming Exercise (Paul & Ann Noble 1971) was designed and tested with the help of two post-graduate planning students at the Polytechnic of Central London in a course unit on decision-simulation model making. It is a role-playing interaction exercise, described briefly as follows.

5.1.2 The primary object in the Marriage Game is that two people, boy (B) and girl (G), are to be married. Before the marriage can take place they have to make a number of decisions. The purpose of the game is for them to make these decisions. Four other people are concerned in this process, his father (F_B), his mother (M_B), her father (F_G), and her mother (M_G). Each role player has a number of goals which he wants to achieve and when all the decisions have been made the achievement or non-achievement of these goals is scored.

5.1.3 In the Marriage Game the persons playing M_G, F_G, M_B, F_B, B and G are each given a role profile and some goals. Each person can reveal as much or as little of his profile to any of the others as he wishes, (remembering that revealing some parts of their profile may detract from the liklihood of achieving their goals), and if anyone wants to add more goals to his list he can do so as long as they do not conflict with his role profile. These ranked goal sheets are handed in to a "friend".

5.1.4 The B and G have a decision sheet which says what decisions they must make before they can get married, and when the decisions are finally made they are recorded on this decision sheet. In arriving at their decisions, the B, G, F_B, M_B, F_G, M_G, all negotiate verbally with each other to decide the preconditions for marriage. The parents can negotiate with each other if they wish. Negotiations can be private or public. Then, after all the pre-marriage decisions have been made, the record sheet is taken to the "Friends" who decide whether the decisions are both viable and compatible. If they are accepted then the "Friends" record the decisions on the display board. Note: Everyone can win or everyone can lose, and in the event of a failure to negotiate all the pre-conditions for marriage, the marriage is called off. This fact is recorded on the display board and the goal cards are distributed and scored as before.

5.1.5 Each player collects another copy of his goal set, numbers them again in the order of importance that he now ascribes to them. (This may or may not be the same as before). If he has acquired extra goals in the course of play then these may be added to the list and ranked. Each player then marks his own list of goals as achieved or not achieved in relation to the displayed decisions. He then records at the bottom of the sheet whether he thinks he has achieved more than he has lost/lost more than he has achieved or that his achievements and non achievements balance out. Finally, score cards are then made public, and a general discussion ensues. The total time it takes to run the Marriage Game is about 1-2 hours including discussion. It is an excellent prototype model of decision-making under conditions of conflicting objectives.

5.2 P.L.U.G. The Polytechnic Land Use Game.

5.2.1 The Polytechnic Land Use Game has been adapted from the Community Land Use Game (by Professor Alan Feldt) for use in a variety of courses dealing with subject matters relating to urban design, architecture, town planning and urban development. Considerable care has been taken to maintain the game in the simplest possible framework of operation in order to facilitate its ready adoption into a wide variety of teaching contexts.

5.2.2 The game attempts to reduce the broad range of variables affecting urban land use decisions to a small number of basic attributes of towns and their surrounding countrysides which appear to make up the more universal and important components of urban systems affecting the development of particular forms of land use in particular locations, including the highway network, the points of access, property taxation, various community services and a particular range of land uses.

5.2.3 Play begins with each player in possession of a fixed amount of capital (usually £35,000) with which he may seek to buy land; construct commercial or residential properties in locations of his choice; and seek to make a profit on his investments through the buying and selling of land, through gaining employment for his residential properties, through putting his industries into operation by hiring employees, or by gaining customers for his service establishments from among the residential units located in the community by other players. Given the initial parameters imposed upon a particular play of the game in the form of transportation networks, taxation policies, the location of the Ports, and the kinds of land uses allowed, most land use decisions are then based upon the degree of accessibility desired between particular forms of land use already developed during play or anticipated land use developments which seem likely to occur in future rounds of the game.

5.2.4 Capital enters the community from the outside world through payments from the bank to industries and is then disseminated through the other sectors of the community by means of payrolls to employees and payments by residences to persons operating localized or centralized shopping centres for the routinized purchases of the necessities of life. Capital leaves the community primarily in the form of payments made to cover transportation costs, through tax payments made to support community services and capital improvements, and through the loss of building value due to the regular depreciation of buildings during each round of play. Careful planning and management on the part of of the players allows them to minimize monetary losses to themselves and to the community 1. through minimizing the distances between particular forms of land use which interact frequently, 2. through prudent management of a community capital improvement programme which will provide enough services to fulfill the needs of a growing community but which will not be wasted on unoccupied land, and 3. through careful handling of their renovation and construction costs on buildings already in operation. With careful management of their investment choices and wise decisions as to the location of their investments players are usually able to realize a return on their investments in excess of 7% per round.

5.2.5 The ending of the game is not defined at this point and it could conceivably continue indefinitely. Most plays, however, tend to terminate after the community has attained a population of several hundred thousand which occurs in 15-20 rounds for moderately prudent players. Playing time is the major limiting factor in the game and most plays of the game require ten hours of play for an adequate introduction to the game itself and the growth of a community of some degree of maturity.

6. Concluding with a Successful Start.

6.1 During the past three years at the Polytechnic of Central London, this author has worked together with colleagues in the Department of Architecture, Surveying and Estate Management, Business Management, and Social and Environmental Planning and also with associates at SAGSET (The Society for Academic Gaming in Education and Training) in generating a number of varied programmes of interactive simulation methods along lines described in this paper.

6.2 The inter-disciplinary interest in these programmes has exceeded that normally encountered in such activities and the enthusiasm that has been generated in the programmes has helped weld together certain aspects of a loosely connected environmental studies programme at the PCL.

6.3 According to plan the present programme of interactive simulation activities scheduled for next year will expand to include: a pre-term role-playing exercise, to assist in the selection of applications; an introductory week of participation and interaction simulation to create course-group identity and measure individual interests and skills at the start of the course; a simulation exercise to service each of the course units on (1) new towns, (2) planning procedures and the organisation of planning, and (3) decision theory; a 3-day mid-course intensive seminar on interactive simulation methods; and a complete 6-week course unit on the design and application of interactive simulation models in urban planning systems.

6.4 This is the position in April 1973; the next stage is to develop a fuller range of simulation exercises to service all the course units in the programme; to integrate interactive simulation methods with the final evaluation processes at the end of course; and to strengthen the links between the course and on-going urban systems simulation work being applied in the field.

REFERENCES:

1) Cynthia Cockburn, Provisions for Planning Education, CES, London, 1972.

2) George Odiorne, Training by Objectives, An Economic Approach to Management Training, Macmillan, New York, 1970.

3) John Taylor and Rex Walford, Simulation in the Classroom, Penguin, London, 1972.

4) Robert Goodman, After the Planners, Pelican, London 1972 - especially the "Introduction" by John Palmer.

5) ibid.

6) Dale Beach, Personnel: The Management of People at Work. Macmillan, New York, 1967.

7) Josephine Klein, Working with Groups, Hutchinson University Press, London, 1963.

8) Alan Elms, Role Playing, Reward and Attitude Change, Van Nostrand Reinhold, New York, 1969.

9) Robert Sarly, MIKEGASIMO: The Milton Keynes Gaming Simulation Model; Its Use in Teaching, Training and Research, PCL, London, 1971.

10) Stanley Seashore and Robert McNeill, Eds., Management of the Urban Crisis, The Free Press, New York, 1971.

ACKNOWLEDGEMENTS:

The author would like to thank Professor Thom Blair, Arthur Edwards, Basil Brenchley, John Palmer and Judith Allen, without whose support throughout the past two and one half years this paper could not have been written. Others too numerous to mention have provided much valuable guidance and help. Nonetheless, the views expressed herein remain those of the author.

THE PUBLICATION AND DISTRIBUTION OF SIMULATION GAMES

By Irving B. Naiburg, Jr.
18 East 64th Street
New York, N. Y. 10021

Perhaps because I have been priviledged to be responsible in part for the successful commercial publication of two important simulation games, SIMSOC by William A. Gamson, and CLUG by Allan G. Feldt, I am aware of the economics of publishing such games for the college market. The basic criterion for successful commercial publication of a simulation game through a large publisher is that the developer of the game has secured wide market testing and acceptance before it can even be seriously considered for commercial publication.

This is because of the very high overheads of large commercial publishers. They are geared to high volume sales of high priced goods such as a basic textbook selling for $9 or $10. Salesmen's commissions are based on dollar volume and they will spend time on such high priced items as textbooks and tend to neglect a relatively low priced item with a less certain market such as a simulation game, even if it sells for as much as $4 or $5.

Thus in my opinion the future of publication of simulation games through the large commercial publishers is not bright. Economic constraints due to declining enrollments at the college level have forced large college publishers to cut back most publishing except for basic hardcover textbooks. Thus even publishers such as The Free Press, where as sociology editor I acquired both SIMSOC and CLUG, are no longer seeking to publish simulation games. They have acquired none since I left The Free Press in 1972.

The situation with the smaller publishing houses is fluid as to their interest or lack of interest in simulation games. It would not be practical for me to name such houses here for that reason. Also, there are new publishers that start up and some of them are interested in simulations.

I would like, in my private capacity as one interested in seeing more simulation games on the market, to offer my help as a resource person to those developers of games who seek advice on how to go about getting a game published or publishing it themselves. Since each game is so different this solution seems more practical than attempting to give general guidelines in this paper. If I can not solve a particular problem, I may be able to direct you to someone who can. Just write me at: 18 East 64th Street, New York, New York 10021. Please let me know how to reach you by telephone because I may have questions regarding your problem.

The one general suggestion that I can make here is that you try to put together an inexpensively reproduced preliminary version of your game and let people know that it is available for a few dollars through announcements in the various newsletters and other media that serve both those interested in simulation and those interested in the subject area of the game. After you have received feedback from users, you may then be able to have it published successfully by a commercial publisher.

You could try to get support for such a version if you need it through your university or through a foundation interested in the subject of your simulation. If you have developed a game and you are seeking suggestions as to how it can be put in a format to make it available inexpensively, I would be glad to give suggestions on that as well.

I hope that the future of publication and distribution of simulation games can be advanced by the "home grown" methods I suggest.

Design Sub Group Summary:

Computer-Based Gaming Simulations

by Philip D. Patterson
Inst. EPA
Washington, D. C. 20015

The Design Sub-Group focusing on computer-based gaming simulations met on three separate occasions during the 1973 National Gaming Council Symposium. The attendees at each successive session diminished in number (from 18 to 11 to 7) and the continuity of attendees was not maintained; that is, only two people attended all three sessions.

In spite of these circumstances, a healthy exchange of ideas, experiences, and recommendations emerged from each session. Since the discussions in each session were so different and so independent, this report will summarize the three sessions and then draw a few general conclusions from the overall sub-group activity.

One might expect that at least half of the diversity that characterizes gamers would be absent when a group of gamers who use computers got together. Such was not the case at this three-session meeting. Approximately 25 different people attended one or all of the three sessions and their gaming interests spanned as wide a spectrum as exists in the entire gaming community.

Computerized gaming models are used in a wide variety of disciplines. The two most widespread uses - military and business - were not represented adequately during the three sessions. Military games were mentioned only briefly in the last session, whereas the sole business gamer was at all three sessions and brought up the subject during the last two sessions.

Harold Guetzkow attended the second session and was the sole voice for the international gaming simulations which are almost exclusively computerized. The use of computer simulation in the field of medicine for diagnosis was discussed in the third session. Gaming as related to Computer Assisted Instruction (CAI) or Learning (CAL) was discussed in the last two sessions.

Prior to the subgroups first meeting, facilitator statements (these are contained in Appendex A) were prepared by three individuals and duplicated for symposium participants. These statements were not received by all of the participants. As it turned out, only about half of the sub group attendees had seen these facilitator statements.

Session 1 - Monday Afternoon

Session 1 was the only one in which the three facilitators were present. Since a number of the attendees and two of the facilitators had not seen the statements ahead of time and no one suggested a reading of the statements, the statements did not really provide any focus or background for the discussion.

The fact that the facilitators all had experience in computerized urban gaming simulations lent a bias to the first session's discussion.

Session 2 - Tuesday Morning

This session was the only one in which every person attending the session was asked to describe their past and future uses of computerized gaming simulations. The first person was interested in having school officials learn to work with computerized data information systems as well as use the data to plan the future of their academic institutions. This person was interested in the software issues of relating computerized data files to user oriented training and gaming tools. One of the facilitators thought the linkage was a relatively minor issue when compared with the selection of which data was to be used and for what training purpose.

A second person from the Internal Revenue Service National Training Center described the use of manual gaming tools used in the past and future plans to tie some computerized training games to the PLATO system developed at the University of Illinois. In Session 3 a PLATO user was able to describe some practical experiences that he had with the PLATO system.

The third person discussed the development and experiences associated with WALRUS II. Here the impact of uncertain developmental budget levels were highlighted. Experiences with METRO-APEX were also mentioned, and this led to the next person who is utilizing the APEX model and calibrating it for the rapidly growing suburban county south of Chicago.

It is a rare instance when the planned use of a gaming simulation by community people is first to learn about the intricacies of their growing county and then secondly to work together to shape the future of their county. This serious use of gaming for more than educational purposes dominated all three sessions, but at this point and on several other ocassions one person raised the issue of the half-hour computer gaming model used for learning specific material.

The computer-based games that are of short duration, have interactive capability via teletype operation, can be built and used with limited funds, and can be used by a single person are a definite segment of the computer gaming spectrum. Some computer games are designed solely for educational purposes and aimed at the average highschool or college student. They may be integrated into the course and used to reinforce some portion of the course content.

The next participant discussed the use of management games for military personnel. There are presently eight computer-assisted management games, four of which are quick-hit tools (i.e., they can be used in less than an hour). The most complex simulates 48 months of military management and takes five days to play.

The next participant discussed four of the most significant developments in Internation Simulation: an all computer version, an interactive version that can be used with or without human input, the further evolutions within the Joint Chiefs of Staff, and a big 60 plus player version. The modular approach for data banks and theory banks used in international simulations was stressed.

Session 3 - Tuesday Afternoon

This session got new information inputs from gamers in the military and medical fields. The medical game in most simple terms is to "make the patient's money go furthest". This means the doctor tests the patient in some systematic way rather than test his own hypotheses of what might be wrong with the patient.

This session attempted to come up with some recommendations for persons interested in designing computer gaming simulations. Some commonly shared ones were:

1. Don't use the computer unless time, manpower and money are more than adequate.
2. Multiply all time estimates from programmers by a factor of two to four.
3. Allow plenty of time for debugging. Testing and debugging will take two to three times the amount of time required for design and programming.
4. Build the team around a key programmer who will be available for the duration of the project. Have a design person who can communicate with and provide a check on the key programmer.
5. A commitment that money cannot buy is required from the entire team.
6. An expertise of computer simulation, game design, and synthesis of these two skills is required or must be developed en route to the design of most computer-based gaming simulations.

The topic of evaluation arose during this session, and all agreed that the funder (usually not the developer) must be convinced that something cost-effective is being built. Sometimes the complexity of the computer games stands in the way of their being tested and demonstrated effective or ineffective.

URBAN PLANNING SUB-GROUP: SUMMARY PAPER

David E. LaHart
Environmental Studies Group
College of Education
The Florida State University
Tallahassee, Florida 32306

The urban environment is a complex, ever changing system of interacting forces. Economic, political, social and environmental constraints provide a core of interrelated, interconnected and interdependent systems. At the center of these systems are human decision-makers, acting individually and in formal and not so formal groupings. Despite this complexity, the urban environment can be understood if the simple planning components are examined critically. Rules and ethics, well defined by culture, underlie these systems. As systems tend toward balance, generalizations and patterns become discernable. These provide frameworks for simulations.

The Urban Planning sub-group considered two types of urban simulations; those with research functions and those with primarily educational functions. While these types are not mutually exclusive, this grouping provides a realistic way of examining the profusion of urban simulations. Allen Feldt was quick to point out that simulations, as planning or training tools, have a relatively low utility because of the uniqueness of each urban area and limitless possibilities for development. Planning simulations should concentrate on situations that are highly generalizable and transferable.

For example, W.A.R.D. (What a Revolting Development) is specifically designed to train people to understand the maze of government agencies involved in neighborhood redevelopment. This particular simulation gives intense training in manipulating bureaucrats and the bureaucracy on many levels of government. Because the theoretical models behind the simulation are highly transferable, this simulation has a relatively high utility and can be modified to fit almost any neighborhood.

Simulations designed to generate policy based on a private technical data base necessarily have a low utility. They are used to examine alternatives to decisions and many such simulations can examine the effects of a wide array of alternative decisions. These so called "predictive powers" of simulations can make significant contributions as research tools and have been used as instruments for community education. For example, a Florida utility company used a simulation-game that enabled customers to "predict" their utility bill based on their present one if current trends in power use and production continue. Simulation participants were allowed a wide number of alternatives but the "best" choices were the ones the power company officials had advocated for several years. The simulation proved a more powerful public education tool than previous mass media campaigns and the utility company was allowed to proceed with its expansion plans. Decision making exercises can bring local situations into sharp focus with very little effort. As more people become trained in simulation design, this method will grow in popularity.

Many sub-group participants felt that future simulation-games will not be predictive necessarily but will emphasize "pre-experiencing". These future simulations will be based on easily modified models developed by the participants. The starting point will be identifying an issue or problem that interests the participants and the simulation will develop from that point.

TEACHING AND TRAINING SUB-GROUP: BUSINESS
SUMMARY STATE OF THE ART PAPER

Myron Uretsky, Department of Computer Applications and Information Systems
New York University 10453
Richard F. Barton, College of Business Administration
Texas Tech University 79409

I. Prospects for the future that have portents in the present state of the art of management and business simulation gaming:

A. The management of companies will be inextricably involved in on-going simulations and games.

B. The education of businessmen will be a large scale effort in simulation and gaming methodology.

II. Present and future resources and technologies supportive of management by simulation and gaming:

A. Identifiable trends:

1. An increasing amount of business data processing is handled on the computer.

2. Data processing brings together in one place data from multiple areas within the firm.

3. There will be computer capacity for the implementation of large simulations.

4. Increasing amounts of decisions are being implemented on the computer.

5. The technology of man-computer interactions via terminals will facilitate gaming simulations of complex business problems.

B. Logical extensions:

1. More attention will be directed towards more accurately estimating future trends, competitors actions, and other uncontrollable variables.

2. Since less time will be needed for data processing and routine decision-making, more managerial time will be available for complex decision analysis.

3. More accuracy will be required in decision-making because the cost of errors will be higher.

4. More managerial time will be spent in building models and simulating the outcomes of possible decisions.

III. Conclusions:

A. It will be technically and operationally feasible to develop a business curriculum based on simulation and gaming methodology.

B. New tools and new experiences need to be designed for this environment.

C. The implications of such an approach are a changed structure for the economics of education.

D. New evaluative criteria will be needed for use in this learning environment and to evaluate the administration of such an educational program.

E. Similar issues will concurrently arise in business enterprises as gaming simulations play more significant roles in assisting real business decisions.

Final report prepared by: Richard F. Barton
Texas Tech University

Myron Uretsky
New York University

RESEARCH APPLICATIONS OF SIMULATION GAMES: SUMMARY PAPER*

Richard L. Dukes
University of Colorado
Colorado Springs 80907

Social science research involving the use of simulation games encompasses the widest imaginable perspective. First, gaming crosses many disciplinary boundaries, and therefore embraces many different types of research problems. Second, there is no clear, agreed upon methodology for use with games, as opposed to the more traditional survey or experimental methodologies which are quite well developed. In the absence of any as yet well developed methodology unique to social science research involving gaming, the most intelligent course of action for developing a methodology for use with games, seems to be to borrow elements from existing methodologies and adapt them for use with games. Suggestions presented below should be taken only as first steps toward a methodology for use with simulation games.

Research Designs

Experimental designs provide the most direct road to causal inferences from independent (manipulated) variables to dependent (measured) variables. Experimental designs are not used more often in most social science research primarily because more often in most social science research primarily because 1) Subjects cannot easily be brought into the laboratory and/or 2) The variables to be studied involve possible danger to the subjects (ex. the study of revolutions). Since gaming research must bring players together to play, the application of experimental treatments as different forms of the same game or as different games becomes straightforward. Since most simulation games have the ability to model potentially dangerous phenomena in relatively safe fashion, games can often avoid the problems encountered in more traditional applications of experimental designs. Since games often provide more complete social situations than the scenarios provided in small group research, games have the potential to avoid some of the artificiality problems of many social-psychological experimental studies. Experimental research involving simulation games also has the advantages of not requiring cover stories to create social situations and operating on autotelic (self-motivated behavior engaged in for its own sake) behavior which does not require the paying or other corecion of players. Simulation gaming research, if intelligently applied, has the potential to avoid many of the ethical problems encountered in much experimental research, as well as to provide strong causal inferences from independent to dependent variables.

Questionnaire and interview techniques have the advantage of the ability to gather larger amounts of data on a large number of individuals in relatively short periods of time. Rather than gathering samples of individuals from a population as is commonly done, data may be easily gathered on individuals who have played a particular game. If the researcher is also conducting the game, of course, data on every individual can be gathered. While many survey research studies attribute group membership from certain background variables such as social class, true group membership (where individuals actually interact with each other) can be accomplished in simulation games. True group membership in simulation games may lead to stronger relationships between variables which counterbalance the usual short-term nature of simulation game research (this relation should be true of most small group research). Many items and scales with demonstrated reliability which have been constructed for questionnaire type research, represent a wealth of untapped resources for gaming research. Often, little or no re-wording is required for such items or scales for use with simulation games. Time-outs or pauses between rounds of games offer logical places for using questionnaire type items which may not interfere with the tempo of game play. While game scores are often "noisy" variables, scoresheets can provide information on the process of game play. Post-game questionnaires, of course, provide information about game play which cannot influence game play and are a way of asking reactive questions. In short, games provide a setting in which over-time data on the process of game play may be gathered without interfering with play. Questionnaires for use with simulation games may have to be tested for reliability with players who have played the game, if the questions contain wording which pertains to the game.

Observer category rating systems such as the Bales method may be quite useful in observing play of simulation games. Observers are usually not unnatural parts of most gaming situations. Usually, observers may roam about the gaming room quite freely without distrubing players too much. Often observers can be built into games in the form of newspaper reporters, etc., but it should be cautioned that such roles may be subject to biased information and "managed news" in ways which an observer <u>as an observer</u> would not. Game administrators as observers may be the most <u>natural</u> way to observe game play, particularly if the administrator does not take sides with particular players or groups of players.

Variables

Independent variables commonly used in simulation game research include different types of players, different games, or different versions of the same game, or play of a single game. Dependent variables often include game play, learning, attitude change, change in the structure of the game through re-design, different qualities of communication among players or between players and others.

Sampling

A common pitfall of sampling procedures often employed in simulation game research involves the inappropriate specification of the sampling unit. Much of the research to date really deals with how groups of players behave, and yet often, the analysis is based on non-aggregated individual-level data. To solve this problem, researchers will have to properly specify the sampling units, and where groups are the units, play the game a greater number of times. The statistical determination of sample size depends on the variability of outcomes on the measured variables which the game can produce, given a particular sample of players. This topic will be discussed below under "reliability," but it will suffice to say that even given the confidence level and the tolerable error, the statistical formula for determining the sample size requires some estimate of the variation on each variable to be measured. Game research where individuals are the sampling units, but where the number of plays of the game is small enough to be considered probably not representative of the distribution of play outcomes which the game can generate, should be avoided. Game research has rarely included random samples of any specified population. Most game research (or more properly, as Goodman terms it, research on plays of games) has utilized availability samples. Where availability samples are used, some sort of randomization procedure where individuals, or even groups, are randomly assigned to experimental treatments, is preferable to single treatment methods.

Reliability

Reliability has traditionally been regarded as a property of measuring instruments, and for simulation gaming research, reliability should be demonstrated for instruments to be used. It also might be useful to consider reliability to be a property of simulation games themselves. We have anticipated this concept of reliability as a property of games, above. For games with a specified number of outcomes, determination of the distribution of these outcomes with regard to a particular variable becomes a much easier task than when the game outcomes have a highly emergent quality, and therefore an almost limitless number of outcomes with regard to a particular variable. What seems to be needed is a large number of plays of a game and reliable measurement (determined in the usual way) of the play and/or outcomes of the game in order to approximate a distribution of possible outcomes. There seems to be no reason that this task cannot be accomplished within the framework of traditional-type game research.

Validity

Validity of simulation games has proven to be difficult to assess beyond establishment of face validity. Part of this problem may stem from reliability problems concerning games, as reliability is considered by most researchers to be a necessary condition for validity. Perhaps more gratifying studies of validity have to wait for more adequate studies concerning the determination of reliability. However, until that time, perhaps a workable definition of face validity can be presented. A game may be said to have face validity for a certain population of players if questions used to measure variables which are asked of players are reliable and similar to those which might be asked concerning the referent system which the game models.

*The research applications of simulation games task group consisted of many persons who participated both formally and informally during the course of the meetings. The task group was a floating body of people and ideas. The group can be considered to have met any time a number of people began to talk about simulation games in social science research, and this was a frequent occurrence. Formal and informal participants included Sarane Boocock, Fred Goodman, Gail Fennessey, James Fennessey, Steve Kidder, David Sarly, Constance Seidner, and at least a half-dozen others whose names I cannot remember, but whose ideas I do. These participants are not responsible for any errors which occur above, as they are mine alone.

SCENARIO - GAME

A Psycho - Heuristic Game for Random Invention of Problems and Solutions.

KLAUS DETTE

Technische Universität Berlin
Lehrstuhl für Stadt- und Regionalplanung
Professor Dipl.-Ing. Friedrich Gunkel

ADVANCED STUDY INSTITUTE
URBAN SYSTEMS SIMULATION
AND ANALYSIS CONFERENCE

Polytechnic of Central London
July 16-27, 1973
London NW1

The purpose of the selected activities, performed by the participants of the SCENARIO - GAME, is to help the players to create original ideas in a selected complex decision-field and to use the offered principles of 'creative thinking' elsewhere.

As all game-participants - they are human beeings - are original thinkers themselves, the SCENARIO - GAME only provides a rough framework which is supposed to initiate the emergence of original ideas. The actual source of ideas are the participants themselves - they are asked to use their imagination as a means of production.

In the SCENARIO - GAME the process of 'idea-evaluation' is separated from the 'idea-getting' process: The final assessment of the quality of the ideas, generated in the SCENARIO - GAME, takes place outside the game. This separation is made, because immediate idea-evaluation inhibits the emergence of new ideas.

The purpose of the SCENARIO - GAME is <u>not</u> to examine specific previously acquired knowledge (<u>reproduction</u>), knowledge as an expected response to an accepted stimulus - <u>but</u> to encourage creative thinking (<u>production</u>), thinking which gives the thinker the impression that after the thinking process he knows more than before.

Unfortunately, the penalties for other than 'expected' responses to stimuli provided during education, professional training and exercise have led to a certain reluctance towards 'non-expected' responses. To moderate this reluctance towards non-expected or original responses, in the SCENARIO - GAME the players who come up with the most original ideas are rewarded by taking up their ideas for further investigation.

To sum up, the SCENARIO - GAME is a method which is supposed to encourage participants, at first, to use their imagination as a means of production in order to experience imagination as a powerfull tool to recognize and to solve human problems in an alternative way, and at second, to use this experience in relevant practical decision-making situations.

SCENARIO combines the two complementary activities of constructing the game and employing it. This has proved to be highly instrumental in motivating the game participants to develop new ideas and to communicate effectively with one another.

Sofar the context of the scenario-writing method is concerned, SCENARIO similarly aims at the development of strategic concepts or missions <u>outside</u> the menu of conventional responses, that is: Standard approaches to problem-formulation and problem-solving are arbitrarily excluded. The often systemic approach of scenario-writing is, however, reduced to a less broad sequence of problem-formulations and solution-formulations. In morphological terms: The end of a SCENARIO-session is, to create a path through the (decision-field-specific) Problem/Solution/Time - Space, where problems and solutions are 'discovered' which are (hopefully) new to most game-participants.

2. Furthermore SCENARIO, if applied in the design of socio-technological-economical systems - might be seen in the context of the 'divergence'-phase, which is according to 'Design Methods' the first step in any design activity. In the divergence-phase the design-situation is supposed to be explored by:

- Widening the area of consideration
- Removing pre-conceptions
- De-programming the human mind
- Exploring the problem-fabric.

As well as defining the 'divergence' phase, the above four statements also define the purposes of SCENARIO; and the attempt is being made to prove that SCENARIO is a useful tool for e.g. decision-making groups in local authorities during divergence-phases.

3. In order to attain the above purposes of SCENARIO, that is in other words, to counteract "carry-over" thinking, and to stimulate game-participants to look at cases other than the straightforward surprise-free problems and solutions, a specific technique is introduced into the SCENARIO-GAME:

   In the first place, participants are asked to step out of the 'real world' and to look at a decision from unusual points of view. In the second place they are encouraged to look at the in this way generated 'phantastic consequences' from ordinary points of view.

In the following, most attention in this paper is given to the description of the first version of a planned series of SCENARIO-GAMEs.

In the first place this version is supposed to be a self-contained game. In the second place it should be seen as an introductory game for interested game-users without previous game-experiences and people who want to design their own games.

It is assumed that this game has some potential to show how the game-designer's pre-conceptions influence the game-design in general and this SCENARIO-GAME-version in particular.

SCENARIO - GAME (OUTLINE) JULY 1973

TIME	MAIN PART	ACTIVITY	SUB - ACTIVITY
1 hour	Part I Development of the game-content	1. Generation of associations 2. Definition of a decision 3. Playing the DOMINO-GAME to understand the rules 4. Adoption of roles	1.1 Forming an object 1.2 Deriving associations 2.1 Selection of a decision-field 2.2 Selection of one decision 3.1 Playing the DOMINO-GAME 3.2 Explanation of the purpose 4.1 Random assignment of associations 4.2 Individual role-characterisation 4.3 Individual role-presentation
1 hour	Part II Looking at a decision from unusual points of view and stating of 'phantastic' consequences	C O F F E E 5. Generation of a scenario, which consists of trees and chains of problems and solutions	5.1 Players try to formulate a problem or solution from the role's point of view 5.2 Cross-examination of the player who stated a problem or solution 5.3 Putting one problem- or solution-card against the decision-card (or a stated problem/solution)
1 hour	Part III Looking at the 'phantastic' consequences from ordinary points of view	C O F F E E 6. Interpretation of the 'phantastic' scenario 7. Final Discussion	6.1 Role-players abandon their roles 6.2 Random selection of a problem- or solution-card 6.3 Looking for analogies 6.4 Writing down transformations

GAMING-SIMULATION RECORD SHEET *

TITLE The Promise of Land

Designer: Harriet Elizabeth Arnold
Date of Construction: November, 1972
Subject Matter: Migration in the United States 1740-1800
Purpose: To teach migration patterns in the United States, 1740-1800, to American History students.
Intended Use: Supplement for eleventh grade history.

Related Games: Ancestors or descendants

PRAGMATICS

Availability: Unpublished
Cost:
Source:

Space and Paraphernalia:
Space requirements: Regular size classroom
Computer requirements: None
Other media required (not provided in kit): 1 map of U.S. (topographic), 6 pencils, Scotch tape
Kit paraphernalia:
Materials and quantities needed: 1 game board, 6 tokens, numbered and lettered cards, rumor cards, six score sheets, 6 participants manuals, 6 small game boards, 1 game board key, 1 instrucor's manual, 6 station cards
Standard/Custom-made:
Documentation: Kniffen, Fred, "Folk Housing: Key to Diffusion," Wolpert, Julian, "Behavioral Aspects of the Decision to Migrate," Wolpert, Julian, "Migration as an Adjustment to Environmental Stress,"

Personnel Requirements:
Number of operators needed: 1 adult supervisor and two students
Operator roles and skills: Supervising adult: introduce materials and collect materials at end of play, supervise play, supervise play; student 1: hand-out numbered and lettered cards student 2: mark score sheets

Player Characteristics:
Number of players: twenty to thirty-six
Age range: seventh through twelfth grades
Prior knowledge or sophistication required or recommended: Must read at seventh grade level
Desired degree of player homogeneity: not applicable

Time parameters:
Preparation time:
Operator training: none required
Player preparation: twenty to fifty minutes
Duration of play:
Introduction: twenty to fifty minutes
Flying time: two to three class periods (fifty minute periods)
Critique: twenty minutes

DESIGN AND OPERATING CHARACTERISTICS:

Stops of play and plot outline: game divided into five stations: station 1; score sheet marked and food distributed, station 2; rumor cards picked up, station 3; rumor cards read and discussed, station 4; students go to board and move their token, station 5; numbered and lettered cards picked up

Player organization:
Individual/ team/ coalition: teams
Number of players/ role or team: up to six players per team

OTHER NOTES: Auxiliary theory is the rumor theory in the game

GAMING-SIMULATION RECORD SHEET*

TITLE: Dialogues on What Could Be

Designer: Joe Falk
Date of construction: Copyright 1973
Subject matter: Evocative communication on any subject or area of interest.
Purpose: A technique to stimulate thinking and conversation to structure but not control.
Intended use: Senior high, college level dialogues, church or special interest group dialogues, social or family dialogues.

Related games: ancestors or descendants - Fireside chats in caves to cocktail parties in tie and tails.

PRAGMATICS

Availability:

Cost: $1.00 retail - normal distribution discounts apply
Source: The Future Associates, 4935 Wells Dr., Shawnee Mission, Kansas 66205

Space and paraphernalia:

Space requirements: Cardtable or small (4 person) conversation groupings.
Computer requirements: none unless comparative evaluations are wanted.
Other media required (not provided in kit): 3" x 5" cards for notes and intro.

Kit paraphernalia:

Materials and quantities needed: Pack contains 5,000 word booklet on the subject matter plus 12 3" x 5" evocation question cards. Each group of 4 needs one set of cards. It is better if each individual has his own pack to prepare for the dialogue and to follow up afterwards.

Standard/custom made:
Documentation:

Personnel requirements:

Number of operators needed: none. Everybody is involved as a player.
Operator roles and skills: Explain rules which are brief and included in pack. Educational input or alternatives in addition to ideas provided improves the session. Each person is expected to bring some idea to share.

Player characteristics:

Number of players: 2/4 minimum - no maximum
Age range: 14 to senior citizens
Prior knowledge or sophistication required or recommended: none
Desired degree of player homogeneity: The more diversified the better if all are willing to open up.

Time parameters:

Preparation time: None required
Operator training: Research on ideas on what could be in area of discussion.
Player preparation: Research on ideas on what could be in area of discussion.
Duration of play: 10 minutes per card - 120 minutes total.
Introduction: 5-10 minutes
Flying time: 120 minutes maximum - 60 minutes minimum.
Critique: Each participant might share his reactions with the group for a minute or two. This is a communication development process. Participants get better with practice.

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline: Each participant draws an evocative question card in turn. He is "evoker" for that card - spends two minutes expressing his feelings on his question and eight minutes evoking his (3) dialogue mates - then next card is drawn by next "evoker". Anyone can draw a card at anytime if bored.

Player organization:

Individual/team/coalition: Individual - if in a large group we suggest you divide into groups of 4 and switch groups every 4 cards and continue the dialogue with others.

Number of players/role or team: Individuals can use introduction card to indicate their interest or a role they would like to play in the discussions, they might also mention a book title as an authority base for their ideas.

Present stage of development: Usable - 6 topics available - should evolve into multimedia method plus an unlimited number of subjects or areas of interest.

OTHER NOTES: The Future Associates as publisher will become a pure Rochdale merchandising cooperative owned by the people who contribute ideas and those who make it all happen. Royalties, commissions or fees will be paid for contributions. Profits will be distributed on the basis of what each member earns in relation to all members total earnings. A member who contributes nothing will get nothing.

GAMING-SIMULATION RECORD SHEET*

TITLE: What Would YOU Do?

Designer: Graduate Assoc. - J. Christensen, C. D'Accurson, N. Frey, S. Juliano
Date of construction: Spring, 1973/ A. Lacks, D. Pfeiffer, J. Zimmerman
Subject matter: Values
Purpose: To provide elementary school children with realistic problems and alternative solutions which help them to define and accept the consequences of their actions.

Intended use:

Related games: ancestors or descendants - None.

PRAGMATICS

Availability: publication pending
Cost:
Source:

Space and paraphernalia:
Space requirements: table or floor space for two-six children
Computer requirements: none
Other media required (not provided in kit): everything available in kit

Kit paraphernalia:
Materials and quantities needed: all materials are provided in kit-dice, pieces for players to move, spinner, set of number cards, several sets of problem cards and board.

Standard/custom-made: dice standard, all other materials custom made
Documentation:

Personnel requirements:
Number of operators needed: one
Operator roles & skills: operator explains rules, supervises play & debriefs.

Player characteristics:
Number of players: two-six plus unlimited observers.
Age range: K-5, inclusion for role play manual for utilization in upper grades (6-8)
Prior knowledge or sophistication required or recommended: None/
Desired degree of player homogeneity: not necessary

Time parameters:
Preparation time: 40 minutes
Operator training: 30 minutes
Player preparation: 10 minutes
Duration of play:
Introduction: done during player preparation
Flying time: minimum 30 minute - variable with sophistication of participants.
Critique: 15 minutes

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline: Player moves his piece through prescribed path on board, length of each move dependent upon throw of dice, at certain junctures player must make a decision as to which path to take. At other times certain locations dictate drawing of a problem card. Child makes a decision about how he would solve the problem with random consequences.

Player organization:

Individual/team/coalition: Individual

Number of players/role or team:

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: INTERACT

Designer: Brent D. Ruben, Ph.D.
Date of construction: 1973
Subject matter: Human Communication, social interaction, & mass communication.
Purpose: Instructional social science
Intended use: High School and University

Related games: ancestors or descendants - Intermedia, Brent D. Ruben, Albert D. Talbott, Henry G. LaBrie III, Lee Brown.
Communication System Simulation, Albert Talbott, Brent Ruben

PRAGMATICS

Availability:
Cost: $5.00 per Manual for participants
Source: Mercer House Press, P. O. Box 681, Kennebunkport, Maine

Space and paraphernalia:
Space requirements: variable
Computer requirements: none
Other media required (not provided in kit): variable

Kit paraphernalia:
Materials and quantities needed: 1 manual per participant, instructor simulation parameter guide sheet.

Standard/custom-made:
Documentation:

Personnel requirements:
Number of operators needed: variable; 1-several
Operator roles and skills: variable; depending upon focus, goals, etc.

Player characteristics:
Number of players: 25-several hundred
Age range: variable 9 above 16
Prior knowledge or sophistication required or recommended: variable
Desired degree of player homogeneity: variable

Time parameters:
Preparation time: variable with number of players, etc.
Operator training: variable
Player preparation: variable
Duration of play:
Introduction: several hours
Flying time: several days to two years
Critique: integral to game

Conference Needs - Table and chairs for discussing the simulation with interested parties.

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline:

(See Gaming-Simulation Record Sheet for details)

Player organization:

Individual/team/coalition:

Number of players/role or team:

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: TEMPO

Designer: Robert L. Sutliff
Date of construction: 1964-1969
Subject matter: Music
Purpose: Education or Recreation
Intended use: General Music Classes

Related games: ancestors or descendents - Bingo

PRAGMATICS

Availability:
Cost:
Source: Not available

Space and paraphernalia:
Space requirements:
Computer requirements: None
Other media required (not provided in kit): Phonograph

Kit paraphernalia:
Materials and quantities needed:
30 Game Boards, 30 Answer Booklets, 75 "calling" cards, 1 Record

Standard/custom-made: Standard
Documentation:

Personnel requirements:
Number of players: 2 - ?
Age range: 6 and up
Prior knowledge or sophistication required or recommended: None
Desired degree of player homogeneity: None is necessary

Time parameters:
Preparation time: 3 minutes
Operator training: None
Player preparation: None
Duration of play: indefinite
Introduction:
Flying time:
Critique:

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline:

Player organization:

Individual/team/coalition: Individual

Number of players/role or team: 2 - ?

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: The Marriage Game

Designer: C. S. Greenblat, P. J. Stein, and N. F. Washburne
Date of construction: 1970-73, Published 1974
Subject matter: Marital decision-making
Purpose: anticipatory socialization for marriage and parenthood
Intended use: classroom use on college level and also use by marriage counselors.

Related games: ancestors or descendants - None.

PRAGMATICS

Availability:

Cost: not yet determined
Source: Random House, Inc. New York, New York

Space and paraphernalia:

Space requirements: classroom
Computer requirements: none
Other media required (not provided in kit): Name tages

Kit paraphernalia:

Materials and quantities needed: Each book serves one student and is consumed during play.

Standard/custom-made: standard
Documentation:

Personnel requirements:

Number of operators needed: one
Operator roles and skills: interpreter of rules

Player characteristics:

Number of players: from two to several hundred
Age range: college and up.
Prior knowledge or sophistication required or recommended: High School grads.
Desired degree of player homogeneity: Not needed

Time parameters:

Preparation time: Two hours
Operator training: Two hours
Player preparation: Two hours
Duration of play: 8 to 10 - 50 minute periods or equivalent
Introduction: 2 hours
Flying time: 8 to 10 hours
Critique: variable

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline:

See Manual

Player organization:
Individual/team/coalition: coalition

Number of players/role or team: couples

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: "Reservation"

Designer: Rod Stadskley & Ron Wagner
Date of construction: Fall 1973
Subject matter: Indian Life on a Reservation
Purpose: Develop awareness of what Indian Life is like on a Reservation
Intended use: Sensitized White People

Related games: ancestors or descendants -

<u>PRAGMATICS</u>

<u>Availability</u>: 1974

Cost: ??

Source: Contact: Ron Stadsklev Institute of Higher Education, Box 6293 University, Alabama 35486

<u>Space and paraphernalia</u>:

Space requirements: a room and some tables

Computer requirements: None

Other media required (not provided in kit):

Kit paraphernalia:

Materials and quantities needed:

Standard/custom-made:

Documentation:

<u>Personnel requirements</u>:

Number of operators needed: One

Operator roles and skills:

<u>Player characteristics</u>:

Number of players: 12-48

Age range: 7th grade - adult

Prior knowledge or sophistication required or recommended: None

Desired degree of player homogeneity: None

<u>Time parameters</u>:

Preparation time:

Operator training: 1 - 2 hours

Player preparation: None

Duration of play: 2 hours and up

Introduction: 20 minutes

Flying time: 1 ½ and up

Critique: 1 hour - 5 hours

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline: Elect tribal chairman, obtain employment, decide what to do with your 24 hours a day and see what results it brings you.

Player organization:
Individual/team/coalition: all three

Number of players/role or team: 1 per role - could easily split roles, also has team dimension, 1/4 of players on a team.

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: Get the Connection?: A Game for Teaching Social Science Concepts

Designer: Richard L. Dukes
Date of construction: 1972-3
Subject matter: Any Social Science Concepts which can be pictorially represented
Purpose: teaching social science concepts
Intended use: classroom teaching devices

Related games: ancestors or descendants - games incorporating Layman Allen's <u>CAP</u> Claims (<u>Equations</u>, <u>On Sets</u>, etc.)

<u>PRAGMATICS</u>

<u>Availability</u>:

Cost: N/A

Source: Paper describing the Game may be obtained from the Author

<u>Space and paraphernalia</u>:

Space requirements: One or several small tables; one table per/4 player Game

Computer requirements: None

Other media required (not provided in kit) :None; chalk board would be helpful.

Kit paraphernalia:

Materials and quantities needed: Magazine pictures depicting concepts. (players make gameboards from these pictures) large piece of acetate to cover board, several grease pencils, several chips.

Standard/custom-made:

Documentation:

<u>Personnel requirements</u>:

Number of operators needed: 1

Operator roles and skills: Operator administrates the game.and provides guidance to players

<u>Player characteristics</u>:

Number of players: any number in groups of four players each

Age range: High School - College

Prior knowledge or sophistication required or recommended: None

Desired degree of player homogeneity: Same or similar familiarity with concepts to be taught

<u>Time parameters</u>:

Preparation time: 10 minutes

Operator training: familiarity with rules & concepts to be taught

Player preparation: None

Duration of play:up to 5 1-hour sessions may be used for construction & play of game.

Introduction: 15 minutes

Flying time: 40 minutes (minimum

Critique: 10 minutes

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline: Players compete with other to arrive at best description (in concepts) of common elements of 2 of four pictures. Players in other groups act as judges, they attempt to identify which two of four pictures are being described by the concepts.

Player organization:

Individual/team/coalition: Individuals compete with each of the other players in their own four person game group. Players in other groups act as judges during certain portions of the game.

Number of players/role or team: 1 player/role; 4 roles/team

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: Much Ado About Marbles

Designer: Armand Lauffer
Date of construction: 1973
Subject matter: Articulation between economic, political, and welfare structure
Purpose: in an urban community.
Intended use: Classroom (Undergraduate & Graduate)
Human Service Professionals & Community Leaders

Related games: ancestors or descendants - Variant of "They Shoot Marbles Don't They?" by Fred Goodman

PRAGMATICS

Availability:

Cost: $50

Source: GSI P.O. Box 1747, F.D.R. Station, New York, New York 10022

Space and paraphernalia:

Space requirements: Table & 100 sq. ft. of space

Computer requirements: None

Other media required (not provided in kit): Blackboard

Kit paraphernalia:

Materials and quantities needed:

Standard/custom-made:

Documentation:

Personnel requirements:

Number of operators needed: One

Operator roles and skills:

Player characteristics:

Number of players: 6 to 60

Age range: Junior High students to adults

Prior knowledge or sophistication required or recommended: None

Desired degree of player homogeneity:

Time parameters:

Preparation time: None

Operator training: None

Player preparation: None

Duration of play:

Introduction: None

Flying time: 2 years

Critique: 1 hour to several days

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline:

(See Gaming-Simulation Record Sheet for details)

Player organization:
Individual/team/coalition:

Number of players/role or team:

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: Docent Clinical Simulations

Patient Management Simulations (Roche), Clinical Simulations for Nursing

Designer: Stanley Wolf

Date of construction: 1971-3

Subject matter: Clinical judgment in medicine and nursing

Purpose: Continuing medical education, in-service & pre-service nursing education

Intended use: Institutional mailings by Roche, direct sales to nursing education institutions and individuals by DC.

Related games: ancestors or descendants - Tab item, Patient Management Problems

PRAGMATICS

Availability:

Cost: Roche PMS provided without charge; Clinical Simulations in Nursing will be about $1 per unit.

Source: Roche & Docent Corporation
430 Manville Road
Pleasantville, New York 10570

Space and paraphernalia:

Space requirements: Not relevant

Computer requirements: None

Other media required (not provided in kit): None

Kit paraphernalia:

Materials and quantities needed: Concealed Image Marking Pen and Concealed Image Simulation Book

Standard/custom-made:

Documentation: Research currently going on in 40 medical schools

Personnel requirements:

Number of operators needed: None

Operator roles and skills: None

Player characteristics:

Number of players: Monastic

Age range: Adult

Prior knowledge or sophistication required or recommended: Varies

Desired degree of player homogeneity: As a branching simulation, there is little homogeneity required.

Time parameters:

Preparation time:

Operator training: None

Player preparation: 5 minutes

Duration of play: 20 minutes - 60 minutes

Introduction:

Flying time:

Critique:

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline:

(See General Introduction in attached sample)

Player organization:
Individual/team/coalition: Not relevant

Number of players/role or team: Monastic use only

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: Terminex

Designer: Rowbatham et al
Date of construction: 1971 - in process
Subject matter: The dying process - telling of the diagnosis.
Purpose: Consciousness-raising for health care professionals.
Intended use: Teaching of basic students; in-service education.

Related games: ancestors or descendants - None known

PRAGMATICS

Availability:

Cost: In mimeographed form; in development
Source:

Space and paraphernalia:

Space requirements: 1 Room at least 40 x 40, adjacent hallway
Computer requirements: None
Other media required (not provided in kit):

Kit paraphernalia:

Materials and quantities needed: Mimeographed sheets for roles and instructions (in development).

Standard/custom-made:
Documentation:

Personnel requirements:

Number of operators needed: One
Operator roles and skills: Orientation, running, post-game discussions

Player characteristics:

Number of players: 15 players (5 M.D.s; 5 patients; 5 observers)
Age range: Teens and beyond
Prior knowledge or sophistication required or recommended: Health care professional (or others such as health sociologists, social scientists of other disciplines.)
Desired degree of player homogeneity: not necessary; can be diverse.

Time parameters:

Preparation time:
Operator training: ??
Player preparation: 1/2 hour
Duration of play:
Introduction: 1/2 hour
Flying time: $2\frac{1}{2}$ hours
Critique: 1 hour

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline: Each M.D. interacts with each patient twice -- once in a "pre-interview", and second -- to tell the diagnosis. The observers judge the degree to which the M.D. reached a pre-set goal for the mode of telling.

Player organization:

Individual/team/coalition: "teams" are M.D. - observer; these two rotate among the patients.

Number of players/role or team: Rotating - M.D. - patient - observer

OTHER NOTES: Has been tested with medical students, graduate nurse students, faculty at Duke University.

Game runner -- Shirley Smoyak (has participated in development)

GAMING-SIMULATION RECORD SHEET*

TITLE: Acres

Designer: George Didot, Jr.
Date of construction: Used since 1971
Subject matter: City land use, development & environmental impact.
Purpose:
Intended use: Stress dynamic interaction of economic/political decision-making teaching used to date in several courses in different schools.

Related games: ancestors or descendants - Best comparison is CLUG

PRAGMATICS

Availability:

Cost: Not yet certain - available late '73

Source: Dartmouth College, Project Compute - Kiewit Computation Center, Hanover, New Hampshire

Space and paraphernalia:

Space requirements: Classroom

Computer requirements: Uses time-sharing Fortran; run to date on GE 635 will be on CDC 6600

Other media required (not provided in kit): Game board desirable - sometimes use forms for input

Kit paraphernalia:

Materials and quantities needed: Manuals

Standard/custom-made:

Documentation: Manuals

Personnel requirements:

Number of operators needed: 1, 2 preferred

Operator roles and skills: Introduction & review of events; initial aid with input.

Player characteristics:

Number of players: 10-20

Age range: 16+

Prior knowledge or sophistication required or recommended: Usable at introduction or advanced levels; need no computer knowledge

Desired degree of player homogeneity: Depends on play desired

Time parameters:

Preparation time:

Operator training: If familiar with gaming, a week on & off of "playing" with it.

Player preparation: 1-2 hrs. & then learn with play.

Duration of play:

Introduction: Should play at least 6 rounds, up to 20+ to date;

Flying time: play 2 - 3 rounds per week in courses; could accelerate

Critique: if desired for gaming-only use.

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline: Preliminary manual available; could bring abbreviated instructions and sample output. Background article with John Sommer in Recent Developments in Urban Gaming, Simulation Council Proceedings Series, Volume 2. Up to 9 teams (2-3 players each) represent business, residents and government; maker decisions on land purchase, development, business applications & operation, transportation, environment, employment, pricing, taxes, zoning, public spending & investment, schools, utilities, etc. Done in time-sharing mode with status & map reports available. Business, environmental and community reports generated end of round.

Player organization:
Individual/team/coalition:

Number of players/role or team:

OTHER NOTES:

GAMING-SIMULATION RECORD SHEET*

TITLE: Obstacle Course

Designer: John T. Foster, Jr.
Date of construction: January 1, 1972 - September 1, 1972
Subject matter: Disorganized Health Clinic
Purpose: Teach university students in nursing and social welfare about client frustrations.
Intended use:

Related games: ancestors or descendants -

PRAGMATICS

Availability:

Cost: $6.50

Source: Instructional Simulation Design, Inc., POB 3330 Leon Station, Tallahassee, Florida 32303

Space and paraphernalia:

Space requirements: Table and six chairs

Computer requirements: None

Other media required (not provided in kit): None

Kit paraphernalia:

Materials and quantities needed: 1 playing board, 1 card deck, play money, 1 die, 6 player's manuals (All needed materials are present in the kit.)

Standard/custom-made:

Documentation:

Personnel requirements:

Number of operators needed: 1

Operator roles and skills: This person should have read both the player's manual and the instructor's handbook.

Player characteristics:

Number of players: 6 - 4

Age range: Adult

Prior knowledge or sophistication required or recommended: Undergraduates in social welfare & nursing.

Desired degree of player homogeneity:

Time parameters:

Preparation time:

Operator training: 1½ hours

Player preparation: None

Duration of play: 1¼ hours

Introduction: 5 minutes

Flying time: 7 minutes

Critique: Varies

DESIGN AND OPERATING CHARACTERISTICS:

Steps of play and plot outline: Young professionals play roles of clients in a health center which is poorly organized.

Player organization:
Individual/team/coalition: Individual

Number of players/role or team:

OTHER NOTES:

ATTENDEES FROM THE NATIONAL GAMING CONFERENCE 1973

Charles H. Adair
Inst. Florida State University
301 Education
Tallahassee, Florida

Layman E. Allen
Inst. University of Michigan
1407 Brooklyn Avenue
Ann Arbor, Michigan 48104

R. H. R. Armstrong
Inst. I.L.G.S.
University of Birmingham
P.O. Box 363
Birmingham, England

Thomas C. Ball
Inst. Ketron, Inc.
1400 Wilson Blvd., 12th Floor
Arlington, Virginia 22209

Richard F. Barton
Inst. Texas Tech. University
College of Business Administration
Lubbock, Texas 79409

Dr. H. A. Becker
Inst. University of Utrecht
2 Heidelberglaan
Utrecht, The Netherlands

Wm. Boles
Inst. Penn State University
S-126 Division of Man-Environment Relations,
University Park, Pennsylvania

David Bresnick
Inst. Baruch College, City University of New York
23rd & Lexington,
New York, New York 10010

Russell H. Bronstein
Inst. Dept. of the Army
222 Lisbon Drive
Newport News, Virginia 23601

Alvin Battle
Inst. Dept. of the Treasury
Internal Revenue Service
1111 Constitution Avenue, N.W.
Washington, D.C. 20224

Jeff Bruninga
Inst. Governor State University
169 Lester Road
Park Forest, Illinois 60466

Virginia Buus
Inst. Campus Ministry
900 Hilgard Avenue
Los Angeles, California 90024

Maxine Champion
Inst. Dept. of the Treasury
Internal Revenue Service
1111 Constitution Avenue, N.W.
Washington, D.C. 20224

Stuart L. Cipinko
Inst. University of Redlands
246 Fourth Street
Redlands, California 92373

Jennifer Clarke
Inst. University of Pittsburgh
803 Bruce Hall
Pittsburgh, Pennsylvania 15260

Don H. Coombs
Inst. Simulation/Gaming/News
Box 3039, University Station
Moscow, Idaho 83843

Shirley D. Craig
Inst. University of Pittsburgh
7070 Forward
Pittsburgh, Pennsylvania 15217

Edward A. Davis
Inst. APL/JHU
8621 Georgia Avenue
Silver Spring, Maryland 20910

Jerry Debenham
Inst. University of Utah
2324 Evergreen Avenue
Salt Lake City, Utah 84109

Gene DePrez
Inst. Rochester Institute of
Technology
One Lomb Memorial Drive
Rochester, New York 14623

Dr. Frank P. Diulus
Inst. S.U.N.Y. College at
Buffalo
Bacon Hall 312B
1300 Elmwood Avenue
Buffalo, New York 14222

Charles Dollar
Inst. Oklahoma State University
Dept. of History
Stillwater, Oklahoma 74074

Dr. Richard D. Duke
Inst. University of Michigan
321 Parillake
Ann Arbor, Michigan 48103

Richard L. Kukes
Inst. University Colorado
at Colorado Springs
4225 B. N. Carefree Circle
Colorado Springs, Colorado 80917

Jacquelyn Engle
Inst. Silver State School
R2, Box 466A
New Albany, Indiana 47150

Leona Farris
Inst. University of Akron
215 A Schrank Hall
Dept. of Home Economics
Akron, Ohio 44325

Allan G. Feldt
Inst. University of Michigan
3105 Sunnywood Drive
Ann Arbor, Michigan 48103

Gail Fennessey
Inst. Academic Games Associates
4000 Linkwood Road
Baltimore, Maryland 21210

Esther Fink
Inst. CUNY
162 St. Johns Place
Brooklyn, New York 11217

Rev. Mallick J. Fitzpatrick, S.J
Fordham Prep School
E. Fordham Road
Bronx, New York 10458

Byron M. Ford
Inst. APL/JHU
8621 Georgia Avenue
Silver Spring, Maryland 20910

John T. Foster, Jr.
Inst. F.A.M.U.
2202 Mulberry Blvd.
Tallahassee, Florida 32303

John H. Geiger
Inst. Metroplan, Inc.
57 North Maple Avenue
Basking Ridge, New Jersey 07920

Nancy Glandon
Inst. University of Redlands
Sociology Department
Redlands, California 92373

William I. Gorden
Inst. Kent State University
School of Speech Communication
Kent, Ohio 44240

Harold Guetzkow
Inst. Northwestern U.
1834 Sheridan Road
Evanston, Illinois 60201

G. Gutenschwager
Inst. Washington University
School of Architecture
St. Louis, Missouri 63130

John D. Henderson
Inst. Ontario Educational
Communications Authority
2180 Yonge Street
Ontario, Canada

John T. Hersney
Inst. University City Science
Center
3508 Market Street
Philadelphia, Pennsylvania 19104

Pamela Hodgson
Inst. OECA
Canada Square
2180 Yonge Street
Toronto, Ontario, Canada
M45 2C1

Dr. John G. Honig
Inst. Dept. Army
7701 Glenmore Spring Way
Bethesda, Maryland 20034

Peter House
Inst. EPA
5330 - 41st Street, N.W.
Washington, D.C. 20015

Norman P. Hummon
Inst. University of Pittsburgh
1140 Beh, U. of Pittsburgh
Pittsburgh, Pennsylvania 15261

David Larry Johnson
Inst. U.S. Govt. Fort Lee, VA.
4106 Montreal Avenue
Prince George, Virginia 23875

Dr. Harold S. Johnson
Inst. Michigan State University
P.O. Box 828
E. Lansing, Michigan 48823

David W. Jones
Inst. Northeastern Ill.
Planning Commission
10 S. Riverside Plaza, 16th Fl.
Chicago, Illinois 60606

Richard Kaiser
Inst. Southwestern Michigan
College
Dowagiac, Michigan 49047

Judy Karshmer
Inst. University of Massachusetts
Apt. 362 Puffton Village
Armhurst, Massachusetts

Margort Kennedy
Inst. University of Pittsburgh
Kant Str. 154a
1000 Berlin, W. Germany

Michael Kennedy
Inst. University of Kentucky
College of Architecture
Pence Hall
Lexington, Kentucky 40506

William V. Kennedy
Inst. Western Pennsylvania Conservancy
204 - 5th Avenue
Pittsburgh, Pennsylvania 15222

Daniel L. Klassen
Inst. SUNY at Stony Brook
Huntington Computer Project
Stony Brook, New York 11790

Dr. L. M. Knolle
Inst. University of Pittsburgh
454 Maple Avenue
Pittsburgh, Pennsylvania 15218

John Lackmann
7370 S. Shore Drive
Chicago, Illinois 60649

Armand Lauffer
Inst. University of Michigan
1015 E. Huron
Ann Arbor, Michigan 48104

R. Stanley LaVallee
Inst. U.S. General Accounting Office
Rm. 6909, 441 G Street, N.W.
Washington, D.C. 20548

Mrs. Barry R. Lawson
Inst. Harwell Assoc.
Pinnacle Road
Harvard, Massachusetts 01451

Patricia Luciani
Inst. N.Y. State Council
on Architecture
792 Columbus Avenue
New York, New York 10025

John P. Marchak
Inst. Changing Times
Education Service
1729 H Street, N.W.
Washington, D.C. 20006

Michael McCarthy
Educational Testing Service
Princeton, New Jersey 88540

Larry A. McClellan
Inst. Governor State University
923 White Oak
Park Forest South, Illinois 60466

George M. McFarland
Inst. S.S.S.
221 Willey Street
Morgantown, West Virginia 26505

Richard McGinty
Inst. University of So. California
3601 S. Flower Street
Los Angeles, California 90007

Harvey Mettè
Inst. Long Island University
Graduate School of Education
Greenvale, New York 11548

Roy I. Miller
Inst. Environmental Simulation Labs.
University of Michigan
Ann Arbor, Michigan 48103

S. K. Moorthi
Inst. John Hopkins University
% 1026 Crystal Mall Bldg. #2
Arlington, Virginia 20460

John Muller
Inst. Lutheran Social Services
2635 - 16th Street, N.W.
Washington, D.C. 20009

Earl S. Mulley
Inst. Center for Simulation Studies
740 Demun
St. Louis, Missouri 63105

Irving B. Naiburg, Jr.
18 East 64th Street
New York, New York 10021

M. N. C. Nair
Inst. Governors State University
Park Forest South, Illinois 60915

Gerald Neufeld
Inst. Florida State
Rm. 418, 415 N. Munroe
Tallahassee, Florida 32301

Jack Newhouse
Inst. West Virginia State
Dept. of Education
1900 E. Washington St.
Charleston, West Virginia 25305

Landon Nichols
Inst. Eastern Kentucky University
366 Transylvania Park
Lexington, Kentucky 40508

Kenneth Park
Inst. New Jersey Dept. Education
Office of Planning
R.P.&E., New Jersey Dept. Education
225 W. State Street
Trenton, New Jersey 08625

Phil Patterson
Inst. EPA
6118 30th Street, N.W.
Washington, D.C. 20015

Charles H. Postma
Inst. Ashland College
Ashland College
Division of Education
Ashland, Ohio 44805

Tricia Y. Martin
Unknown Address

Linda K. Pratt
Inst. National Laboratory for
Higher Education
122 Radcliff Circle
Durham, North Carolina 27707

Erwin Rausem
Didactic Systems
Box 457
Cranford, New Jersey 07016

Earl J. Reeves
Inst. University of Tulsa
600 S. College
Tulsa, Oklahoma 74104

R. Roger Remington
Inst. RIT
Rochester Institute of Technology
One Lomb Memorial Drive
Rochester, New York 14623

Carl H. Rinne
Inst. University of Michigan
at Flint
1321 E. Court Street
Flint, Michigan 48503

Clark D. Rogers
Inst. University of Pittsburgh
803 Bruce Hall
Pittsburgh, Pennsylvania 15260

Karin Rolett
Inst. University of North Carolina
Dept. of Health Education
School of Public Health
Chapel Hill, North Carolina 27514

Larry Ross
Inst. Governors State University
31 Krotiak
Park Forest, Illinois 60466

Frank S. Rubin
Inst. M.S.S.D. Gallaudet
Kendall Green - 7th & Florida Ave.,N.E.
Washington, D.C. 20002

Frederick C. Ryan, Jr.
Inst. Office of Planning, N.J.
Dept. of Education
225 W. State Street
Trenton, New Jersey 08025

Robert M. Sarly
Inst. RADIUS
36B South Hill Park
London NW3, England

Carla Schissel
Inst. University of Rochester
260 Crittenden Blvd.
Rochester, New York 14642

Dr. Daniel Schores
Inst. Austin College
P.O. Box 1601
Sherman, Texas 75090

Teresa Sherr
Inst. Westat. Inc.
11600 Nebel Street
Rockville, Maryland 20852

Richard I. Shrager
Inst. NIH
National Institutes of Health
Bldg. 12A, Rm. 2007
Bethesda, Maryland 20014

Richard Schusler
Inst. Kansas University
Bailey Hall
Lawrence, Kansas 66044

Connie Seidner
Inst. Boston University
27 Kingman Road
Newton, Maryland 02161

Herman Sievering
Inst. GSU
College of Environmental Science
Park Forest S, Illinois 60466

James Sinopoli
Inst. Governors State University
1996 City View
Eugene, Oregon 97402

Peter Smit
Inst. University
Noorderstraut 5
Utrecht, Netherlands

Shirley A. Smoyak
Inst. Rutgers University
4 Roney Road
Edison, New Jersey 08817

Edward J. Springer
320 Cathedral Street
Baltimore, Maryland 21201

Ron Stadsklev
Inst. University of Alabama
I.H.E.R.S.
Box 6293
University, Alabama 35486

Mary Ann E. Steger
Inst. Southern Illinois University
Route 1
Harrisburg, Illinois 62946

Barbara Steinwachs
Inst. University of Michigan
Extension Gaming Service
412 Maynard
Ann Arbor, Michigan 48104

Susan T. Tait
Inst. State Dept.
M/MS, Rm. 2238NS
Washington, D.C. 20520

Albert D. Talbott
Inst. University of Iowa
School of Journalism,
Iowa City, Iowa 52242

Mary Talley
Inst. DHEW
1815 - 37th St., N.W.
Washington, D.C. 20007

Harriet Tamminga
Inst. University of Denver
1949 So. Emerson
Denver, Colorado 80210

Barbara Tarker
RBS
1700 Market St., 17th Floor
Philadelphia, Pennsylvania

Sivasailam Thiagarajan
Inst. CITH
2853 East Tenth
Bloomington, Indiana 47401

Jay C. Thompson
Inst. Ball State University
Area of Curriculum, Teachers College
Mancie, Indiana 47306

Myron Uretsky
Inst. NYU
100 Trinity Place
New York, New York 10006

Violet L. Wagener
Inst. Simulation/Gaming/News
7060 Roaring Fork Trail
Boulder, Colorado 80301

Jerry K. Ward
Inst. NDATC
10206 Bushride Dr.
Elliott City, Maryland 21043

Andrew Washburn
Inst. USC
3601 So. Flower St.
Los Angeles, California 90007

Major J. D. Watson
Inst. US Naval Academy
7109 Thrasher Road
McLean, Virginia 22101

M. Whithed
Inst. Temple
Political Science Dept.
Philadelphia, Pennsylvania 19122

Georgeann Wilcoxson
Inst. UPUSA
475 Riverside Dr., Rm. 1168
New York, New York 10017

Clarence M. Williams
Inst. Gallaudet College
Kendall Green
Washington, D.C. 20002

Don Wolff
Inst. City University of New York
72 Kendall Road
Kendall Park, New Jersey 08824

Harlan Wright
Inst. Temple University
233 = 1300 W. Columbia Avenue
Philadelphia, Pennsylvania 19122

Cathy Greenblat
Inst. Rutgers University
Dept. of Sociology,
Douglass College
New Brunswick, New Jersey 08903

Dette Klaus
Inst. Technical University Berlin
38 Koebis Strasse
1 Berlin 30, Germany

FORM NBS-114A (1-71)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBS SP-395	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE Simulation and Gaming. Proceedings of the 12th Annual Symposium National Gaming Council and the 4th Annual Conference International Simulation and Gaming Association, NBS, Gaithersburg, Md., September 17-19, 1973.

5. Publication Date June 1974

6. Performing Organization Code

7. AUTHOR(S) John E. Moriarty, Editor

8. Performing Organization

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No. 4314591

11. Contract/Grant No.

12. Sponsoring Organization Name and Address

National Bureau of Standards
Technical Analysis Division

13. Type of Report & Period Covered Proceedings Conference: 9-17 to 9-19 1973

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

Co-sponsors: The United States Environmental Protection Agency
Rutgers University - Library of Congress Catalog Number: 74-704

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

This document contains the proceedings of a Gaming Conference along with many formal papers assembled to provide a comprehensive collection of up to date gaming information. The proceedings are divided into three major sections, namely, Theory and Evaluation, Design and applications. Each section contains the text of informal workshops held during the Conference and a selection of formal papers. There is a significant amount of reference material cited in the formal papers along with timely questions and challenges explored and amplified in the workshops.

17. KEY WORDS (Alphabetical order, separated by semicolons)

Computer; decision-making; games; learning; manual games; simulation.

18. AVAILABILITY STATEMENT

[XX] UNLIMITED.

[ ] FOR OFFICIAL DISTRIBUTION. DO NOT RELEASE TO NTIS.

19. SECURITY CLASS (THIS REPORT) XX UNCLASSIFIED

20. SECURITY CLASS (THIS PAGE) XX UNCLASSIFIED

21. NO. OF PAGES 458

22. Price $4.25

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH reports National Bureau of Standards research and development in physics, mathematics, and chemistry. Comprehensive scientific papers give complete details of the work, including laboratory data, experimental procedures, and theoretical and mathematical analyses. Illustrated with photographs, drawings, and charts. Includes listings of other NBS papers as issued.

Published in two sections, available separately:

- **Physics and Chemistry (Section A)**

Papers of interest primarily to scientists working in these fields. This section covers a broad range of physical and chemical research, with major emphasis on standards of physical measurement, fundamental constants, and properties of matter. Issued six times a year. Annual subscription: Domestic, $17.00; Foreign, $21.25.

- **Mathematical Sciences (Section B)**

Studies and compilations designed mainly for the mathematician and theoretical physicist. Topics in mathematical statistics, theory of experiment design, numerical analysis, theoretical physics and chemistry, logical design and programming of computers and computer systems. Short numerical tables. Issued quarterly. Annual subscription: Domestic, $9.00; Foreign, $11.25.

DIMENSIONS, NBS

The best single source of information concerning the Bureau's measurement, research, developmental, cooperative, and publication activities, this monthly publication is designed for the layman and also for the industry-oriented individual whose daily work involves intimate contact with science and technology *—for engineers, chemists, physicists, research managers, product-development managers, and company executives.* Annual subscription: Domestic, $6.50; Foreign, $8.25.

NONPERIODICALS

Applied Mathematics Series. Mathematical tables, manuals, and studies.

Building Science Series. Research results, test methods, and performance criteria of building materials, components, systems, and structures.

Handbooks. Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications. Proceedings of NBS conferences, bibliographies, annual reports, wall charts, pamphlets, etc.

Monographs. Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

National Standard Reference Data Series. NSRDS provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated.

Product Standards. Provide requirements for sizes, types, quality, and methods for testing various industrial products. These standards are developed cooperatively with interested Government and industry groups and provide the basis for common understanding of product characteristics for both buyers and sellers. Their use is voluntary.

Technical Notes. This series consists of communications and reports (covering both other-agency and NBS-sponsored work) of limited or transitory interest.

Federal Information Processing Standards Publications. This series is the official publication within the Federal Government for information on standards adopted and promulgated under the Public Law 89–306, and Bureau of the Budget Circular A–86 entitled, Standardization of Data Elements and Codes in Data Systems.

Consumer Information Series. Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

BIBLIOGRAPHIC SUBSCRIPTION SERVICES

The following current-awareness and literature-survey bibliographies are issued periodically by the Bureau:

Cryogenic Data Center Current Awareness Service (Publications and Reports of Interest in Cryogenics). A literature survey issued weekly. Annual subscription: Domestic, $20.00; foreign, $25.00.

Liquefied Natural Gas. A literature survey issued quarterly. Annual subscription: $20.00.

Superconducting Devices and Materials. A literature survey issued quarterly. Annual subscription: $20.00. Send subscription orders and remittances for the preceding bibliographic services to the U.S. Department of Commerce, National Technical Information Service, Springfield, Va. 22151.

Electromagnetic Metrology Current Awareness Service (Abstracts of Selected Articles on Measurement Techniques and Standards of Electromagnetic Quantities from D-C to Millimeter-Wave Frequencies). Issued monthly. Annual subscription: $100.00 (Special rates for multi-subscriptions). Send subscription order and remittance to the Electromagnetic Metrology Information Center, Electromagnetics Division, National Bureau of Standards, Boulder, Colo. 80302.

Order NBS publications (except Bibliographic Subscription Services) from: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

UNITED STATES
GOVERNMENT PRINTING OFFICE
PUBLIC DOCUMENTS DEPARTMENT
WASHINGTON, D.C. 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U.S. GOVERNMENT PRINTING OFFICE
375

U.S.MAIL

AMERICAN REVOLUTION BICENTENNIAL
1776-1976

1298